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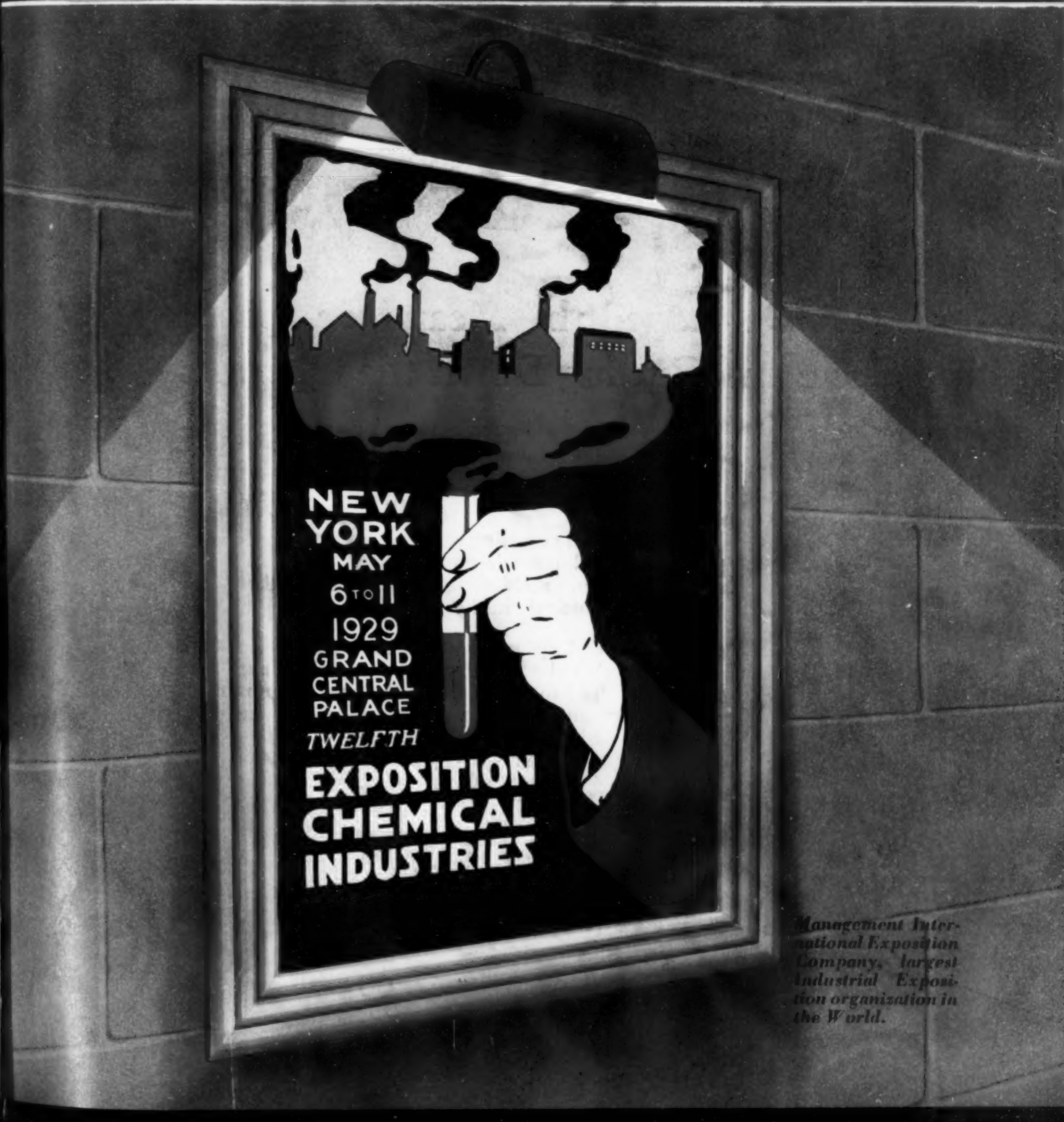

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CHEMICAL & METALLURGICAL ENGINEERING

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CHEMICAL
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ENGINEERING

M. A. Williamson, *Publishing Director*

VOLUME THIRTY-SIX - NUMBER THREE

MARCH, 1929

S. D. KIRKPATRICK, *Editor*

A Broader Perspective on Tariff Matters

IN TARIFF parlance the term "raw material" possesses a convenient flexibility that many chemical manufacturers have discovered to their discomfort. Finished products of chemical industry are the primary ingredients of other manufacturing operations and when the chemical consuming industries make their representation to Congress for tariff protection there is often an appeal for duty-free importation of what these industries regard as their basic raw materials. Thus the chemical manufacturer sometimes finds himself being ground in the tariff mill between the upper stone of controversy with his own customers and the nether stone of foreign competition. More than ever there is emphasized the necessity for a broad, public-spirited attitude toward these inter-industry problems of tariff adjustment.

RADICAL differences of opinion regarding tariff policy on nitrogen products recently placed certain chemical engineering industries in two camps, squarely aligned against each other. The synthetic and byproduct ammonia manufacturers naturally wished to have the present tariff on ammonium sulphate continued and corresponding duties imposed on other nitrogen carriers equivalent to ammonium sulphate in industrial significance. The fertilizer industry, on the other hand, joined with the farm group in asking that this tariff be eliminated. Furthermore the industry vigorously contended that while fertilizer materials containing but one plant food should be placed on the free list, all products containing two or more of these essential elements should be made dutiable at 25 per cent ad valorem. Thus we see fine distinctions being drawn between ammonium sulphate the "raw material" and ammonium phosphate the competitive "finished product," between synthetic urea and the "Nitrophoska" materials made in the same German nitrogen plants.

FROM one viewpoint all of these desires of the fertilizer industry are natural and proper; from another they appear selfish and short-sighted. There may be a lesson for the fertilizer manufacturer in the experience of the American dye industry. For years the so-called "intermediates" were imported free of duty or at low rates compared with those for finished dyes. The result was that American factories became mere assembling plants for hooking together the semi-manufactured ingredients made abroad. Then in the tariff act of 1922 duties on intermediates were raised almost to the same level as the finished products and the result was the establishment of a well-rounded industry in this country. In fact, once intermediates were made on a thriving basis, the manufacture of finished dyes rapidly expanded and costs were often lowered below the pre-war levels.

FERTILIZER manufacturers can well afford to encourage an air-nitrogen industry in this country that will produce the essential ingredients from which mixed fertilizers are made. Substantial duties on all of these synthetic materials whether they contain one, two or all three of the essential plant foods would not penalize the consumer but would help to create a complete and efficient industry. And, of course, these are not alone among the chemical engineering products that are affected by conflicting views on tariff adjustment. In all such cases, however, the governing principle should be that of the long-time improvement and development of the chemical industry as a whole. The narrow request for the immediate gain must sometimes be sacrificed in the broader spirit of public service. The long-run effect in building up a prosperous industry, efficient in all of its branches, is vastly more important than a small temporary advantage in tariff protection.

Avoiding Dangerous Hysteria in Forecasting Fertilizer Sales

REPORTS of reduced shipments of fertilizers during the winter season as compared with last year, and especially with the small fertilizer tag sales reported by various Southern states, have led some individuals interested in this business to unwarranted hysterical interpretations. The prospects of this industry for the present fertilizer year appear certainly to be for somewhat smaller consumption of mixed fertilizers, especially in cotton states of the Southeast; but the extravagant estimates of the decrease to be expected in which some individuals have apparently indulged is not warranted.

Those who are concerned with the supply of chemicals for fertilizer manufacture or with the fertilizer industry itself will do well to recall the fact that delayed sales do not always mean a complete loss of business for the season as a whole. It seems inevitable at this time that there should be some small shrinkage in total use of fertilizer during the spring planting season. It is hardly possible that late purchases will recoup all of the losses already occasioned by the postponed purchasing. The credit situation throughout the South, especially in the Southeastern cotton states, is very stringent. This alone would account for much, if not most of the difficulty being experienced. But this situation is not sufficient to warrant anything like the calamitous forecasting of a 25 to 30 per cent decrease, in which some individuals have indulged. Such forecasts are unwarranted and detrimental to the interests of every important factor in the business.

Incompleted Research Should Not Hold Up Construction

THE recent meeting at the Bureau of Standards of the majority of those known to be actively studying pipe line corrosion demonstrated the attention which this problem is at last receiving. Its solution will ultimately involve the evaluation and measurement of a large and yet unknown number of influencing factors. In the meantime corrosion proceeds to an extent which should be possible, at least, of reduction; money is wasted in ineffective expenditures based on hastily formed and false conclusions.

Doubtless much work has been done without the information gained having been made public. In any case, it must be recognized that no correlation has yet been definitely established between experimental and service corrosion conditions. Research along these lines, already well started by many workers, should continue. The subject must eventually be thoroughly understood; the economic benefits which may result are almost incalculable.

Research in any line is quite rightly never considered complete until the last detail is settled. In this case, however, the engineer must proceed with construction. Along with continued work, the research laboratory should furnish the engineer with information periodically revised to reflect accurately all knowledge of the subject then available.

The work described elsewhere in this issue by W. Thompson Smith of Ford, Bacon and Davis, Incorporated, was a thorough-going attempt, within practical limits, to use the knowledge thus far gained concerning soil corrosion. It is not claimed that the prediction of corrosive action is possible with complete accuracy by this method or any other yet developed. Research may be expected to develop important, perhaps fundamental revisions in any method of predicting the degree of corrosion to be anticipated. But the engineer cannot wait for the exact and final answer. Research workers should, from time to time, publish suggested new methods or improvements in existing methods, always qualified if necessary as incomplete and provisional. The immediate economic value of even incomplete and possibly somewhat inaccurate methods of estimating soil corrosion justifies the deviation, in this special case, from the established standards of procedure.

It is decidedly valuable, but insufficient, to know how good a protective coating may be. It should also be possible to determine with reasonable accuracy how good a coating is required. From the standpoint of economy as well as of scientific interest, the subject warrants thorough investigation having as its object the immediate development, and such subsequent revision as may be necessary, of a method complete enough to give reliable results and yet simple enough to afford no excuse for its not being generally used.

Small Manufacturers Should Interest Engineering Students in Their Industry

NEARLY every type of manufacturing has followed the trend towards scientific research and development, which is a condition quite different from that which prevailed twelve or fifteen years ago. This tendency has been so strong that some of the most powerful companies have gone into the open market to compete for the technically trained men. Consequently, these wealthy organizations have been able to select the highest grade men, leaving the smaller companies in an unfavorable position. To avoid being forced to take the less desirable technical graduates, the less powerful manufacturers must recognize that the condition exists and take steps to interest the engineering students in the universities in their type of industry. This can best be accomplished through salaried educational directors or committees appointed by associations.

The number of companies is steadily increasing that each year thoroughly canvass the technical colleges, signing up the most promising graduates. Some of these concerns offer employment to the undergraduates during the summer months in an effort to encourage interest and specialization in their particular industry. A large manufacturer of electrical equipment entertains the senior class of one of the largest engineering schools for two days each spring, showing the men through the various departments of the plant and explaining the work of the organization.

The majority of the small organizations individually cannot afford to canvass the colleges nor can they afford to train the men, but the way is open for them to do so collectively through associations. Two years ago the Technical Association of the Pulp and Paper Industry recognized that the pulp and paper industry deserved a more favorable situation in regard to its supply of technical men and that the technical man would do a better job for the paper makers if he built up an acquaintance with the industry while he was still in college. Allen Abrams and his committee, appointed by this organization, have done an excellent job in getting the student interested in paper work early in his college career,

explaining to him what the industry offers and what it expects of him; giving him an opportunity during his summer vacations to go into the mill and work where he can absorb practical ideas and get a vision of what there is to do. After one or two summers contact with the industry he can decide whether it appeals to him; and likewise the industry can decide whether he is a likely candidate.

In this way the pulp and paper mills look over prospective employees; and who can deny that this early and intimate association is interesting ambitious young men in their mills for livelihood after graduation?

Nitrate Output and Stocks Both Appear Excessive

PRELIMINARY reports of Chilean nitrate production during 1928 indicate an output of approximately 3,500,000 short tons. World stocks at the end of the year reached the very large total of 2,350,000 short tons. Both of these figures seem to imply either an undue optimism as to the capacity of the world for consumption of Chilean nitrate or an inability of nitrate producers to regulate their output in accordance with known world needs.

Regardless of prices obtainable for nitrogen products in the American market there is certain to be a large and slowly growing output of ammonium sulphate or other byproduct ammonia derivatives. The production of synthetic ammonia products is growing steadily and at a very rapid rate. Under the circumstances, American nitrogen producers may look forward to continued low, in fact continually decreasing, inorganic nitrogen prices, unless all signs fail. However, this forecast with its possibilities of wide fluctuations is not necessarily one in which the nitrogen consumer should take great satisfaction. It does not make for stability in the producing industry to have prices below cost prevailing at frequent intervals.

It would appear a matter of good business for all interests in the nitrogen industry to work toward a stabilization in production. Certainly there is no prospect that the world will absorb more than about 2,500,000 short tons of Chilean nitrate per year. Hence, a production of a million tons in excess of this rate is merely an invitation to unsettlement of the whole industry and potential disaster for the producers. Such a result could be really beneficial to no one.

Modernizing Plant Location

"NINETY PER CENT of American factories are not rightly located if judged on a broad economic basis." This is in substance the rather alarming comment of one of the leaders of the Chamber of Commerce of the United States whose main job is to keep in touch with the manufacturing business of the nation. The same authoritative source has made an almost equally disturbing comment on a tendency of American management to stay too long in authority, resulting in an accumulated obsolescence that is a handicap to the industry.

Perhaps the chemical engineering industries have suffered as little from these two faults as any. This fortunate fact is more or less the result of the comparative youth of the industries in which chemical engineers are engaged. Nevertheless, we have many queer and seemingly uneconomic factors of location to illustrate the applicability of the criticism quoted. For example, all persons acquainted with the rubber industry know that it was a mere coincidence that Akron, Ohio, has become a famous world center of rubber manufacture. No one could justify such a location on purely economic grounds were he to start the industry all over again. But with existing industry centering there it is quite a different thing to say that a management should move away from Akron simply to find a site that in theory is economically preferable.

No group of industries has a more frequent rejuvenation through the establishment of new plants and new processes than do most of the chemical engineering industries. This fact introduces a certain element of financial hazard, but there is a large compensating factor in the opportunity for increased profits as a company as it replaces its obsolete plants and equipment. A management will make no mistake if it occasionally sweeps aside all considerations of piecemeal renewal and fractional replacement of plants in order to make at least a theoretical study of the results which would follow from building an entirely new plant in a new location chosen because of its long-time and over-all economic advantages. Such a thorough and basic study will often reveal surprising possibilities and may occasionally more than justify a radical change of company affairs.

Hazardous Ingenuity

RECENTLY in a contemporary publication there was an article recommending the use of oxygen cylinders as storage containers for gas samples used in experimental work. Very rightly the Compressed Gas Manufacturers' Association takes official notice of this dangerous recommendation. It is urging that all of its members call attention to the hazard involved in the introduction of any foreign substance into an oxygen cylinder.

Our daily and unavoidable association with oxygen leads us to regard this element as harmless enough under usual conditions. Industrially, we may perhaps forget that high pressure oxygen in contact with even small quantities of combustible materials, such as oil or hydrocarbon gases, becomes potentially a high explosive.

Proofs of this statement are not difficult to find. A case in point was that of a disastrous explosion which occurred several years ago in the physics laboratory of one of the large Eastern universities. In some manner, never satisfactorily explained, although it is believed that some unwitting employee used oil in the lubrication of an oxygen compressor, the compressor installation exploded with such force that the three floors above the compressor room were raised several inches and many windows were shattered. Only scant traces were found of the two men who had been working near the compressor. And as there were classes in progress on upper floors at the time of the blast, several students suffered broken bones from the almost instantaneous lift of the floors beneath them.

Hence, the warning is always timely against the use of any form of combustible with oxygen-containing or oxygen-handling and especially oxygen-compressing equipment. The use of industrial oxygen cylinders for any purpose for which they were not intended is both unfair to the company owning the container and highly dangerous to the experimenter.

Planning EQUIPMENT and LAYOUT *in a Fine Chemical Plant*

By James A. Lee

Assistant Editor, Chem. & Met.

WHAT MORE perfect spot could an engineer select to situate a fine chemical plant than on the shores of Lake Michigan, away from the dust and dirt of the city, in a meadow bordered on two sides by railroads providing excellent shipping facilities, and rapid transportation for employees? Such a setting Dr. W. C. Abbott chose when it became evident that the Abbott Laboratories had outgrown its plant in Ravenswood and must move away from the rapidly encroaching city of Chicago.

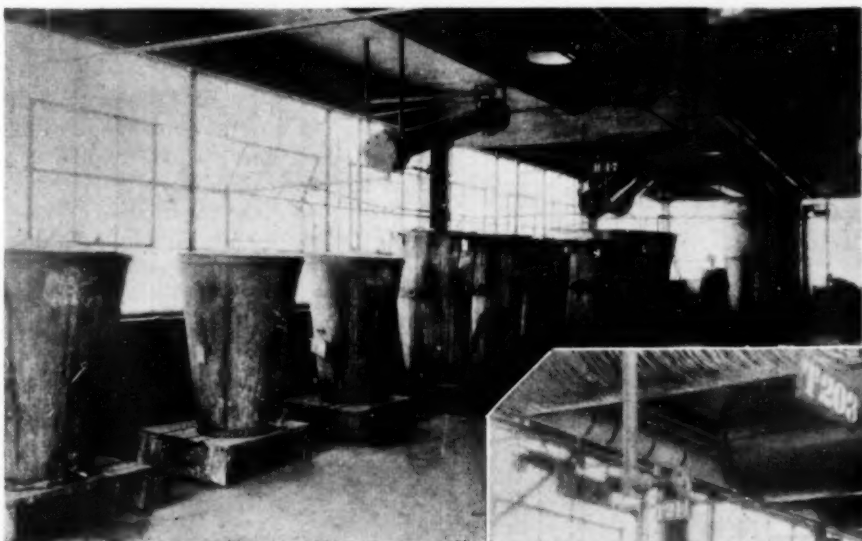
This plant is unique among fine chemical plants and of interest to chemical engineers because of the unusually efficient arrangement of buildings and selection of equipment which characterize the plant. Much credit is due E. H. Ravenscroft, general superintendent and engineer responsible for designing and laying out the plant. In planning care was given to the selection of types of buildings best adapted to the work to be done, their location in respect to storage and shipping facilities, and their design in order to best accommodate the manufacturing operations; and to the type of equipment that would be serviceable in the production of many different chemicals. The last was a particularly important feature for in the case of many of the preparations several months' supplies could be made in a few days, and if there were no further use for the equipment it would necessarily remain idle most of the time, occupying space, corroding and tying up capital. The complete flexibility in the application of equipment is perhaps the engineer's greatest achievement.

In designing the buildings for a factory in which over 1,000 different pharmaceutical preparations could be manufactured, various factors had to be considered. Because of the hazardous nature of many of the operations every precaution was taken against loss from fire and explosions. Dust and objectionable fumes in some of the operations had to be provided for, while in other cases the dyeing nature of the material made it advantageous to isolate the operation in a separate structure or room. In one or two cases the buildings were so designed that gravity flow could be applied in the installation, while the others were designed for vertical material handling.

Provision was made for housing the general administration department in several buildings; the offices, library (which is one of the finest of its kind in the country), cafeteria, printing plant and laboratories, for general and clinical research, and for the control of raw and finished products in a concrete three-story structure; the sanitary biological laboratories in which control of manufactured products of such nature is maintained along with experimental work along corresponding lines in one-story buildings; the trial manufacturing of many new chemicals developed by the research laboratories in a building equipped on a semi-commercial scale. The buildings for storing the crude drugs, chemicals and solvents were located in the center of the group of synthetic medicinal chemical buildings and the one in which the drugs of vegetable origin are manufactured. The solvents including grain and denatured alcohol, benzol, toluol, acetone and naphtha were placed under the supervision of a man whose duty it is to receive and dispense them. When a foreman requires a solvent it is piped to the particular vessel in which it is used, the recovered solvent returned to a small tank located in the storage building, where it is measured by the man in charge and the foreman given credit for the amount before returning it to the storage tanks. Four of these tanks with a capacity of 9,000 gal. each are provided and it is esti-

mated that 90 per cent of the solvent used is recovered.

A four-story concrete structure was provided for manufacturing medicinals of vegetable origin, resinoids, alkaloids, glucosides and extracts, because of the large volume and weight of the materials where gravity flow could be used in handling. The crude drugs are delivered on trucks from the adjacent storage building to the top floor by means of an elevator. According to the nature of the drug it is delivered to either a Mead, Abbé or Straub grinder depending upon the capacity and ease of grinding. The ground drug falls into the hopper suspended from the ceiling of the floor below. These hoppers have a capacity of 2,000 cubic feet. In order to prevent dust explosions the air is released from the hopper by means of stocking arresters. The mixer is located on the third floor directly below the outlet in the bottom of the hopper and is used for mixing the fine particles of the drug and for moistening with the solvent. This is done to prevent channels forming in the mass during percolation. The outlet in the bottom of the mixer is connected with the percolator on the floor below, thus permitting the transfer of the moist and ground drug. The moistened mixture is packed into the percolator on the second floor and alcohol or a suitable menstruum is allowed to filter through the charge extracting the active principle passing down to the vacuum still on the floor below. In this the solvent is vaporized and sent to the third floor where it is condensed and the operation repeated. After the extraction is completed the solvent is



Percolators Used in Extracting Drugs

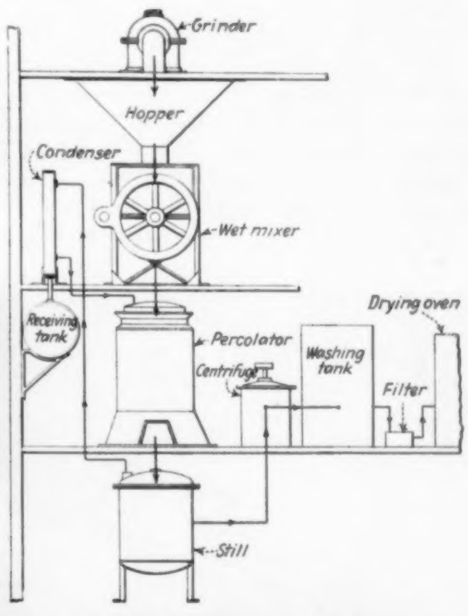
distilled into the temporary receiving tank from which it is sent to the storage building for credit. The insoluble portion of the mart containing about its own weight of solvent is then transferred from the percolator to a horizontal steam-heated vacuum cylinder equipped with a screw stirrer. The remaining solvent is distilled off and returned along with the main body of the solvent, in the temporary receiving tank mentioned above, to the solvent storage in the nearby building later to be used again. The extract (crude crystalline alkaloids) is removed from the still, carried to the second floor where it is centrifuged and precipitated in wooden tanks. The precipitate is then removed from the mother liquor by filtering through cotton fabric, stretched over wooden frames. It is necessary to use this means of filtration since the resinous nature of the drug does not permit the use of more rapid means such as filter presses. The moist extract is dried in vacuum driers heated with steam coils.

It is evident how fully gravity flow has been applied in this installation and that a large saving in material handling has been the result, for while it is true that the extract removed from the still is carried to the second floor for further treatment, it is of small volume compared with the original materials.

The finished preparations are sent to the pharmaceutical department where about fifty per cent is used in the company's products and the remainder sold.

The group of buildings provided for manufacturing of synthetic medicinal chemicals consists of three one-

Elevation of Drug Extract Building Showing how Gravity Flow has been Used.



View of Second Floor of Drug Extract Building
Equipment for solvent recovery and percolators are seen along the side, and on the right the cloth gravity filters for resinous material.

story buildings with saw-tooth roofs constructed of steel and concrete; the doors and windows are set in loosely, the doors being in alternate positions for safety against explosions and fires which are not unknown in the manufacture of such chemicals. These buildings are further subdivided to prevent contamination from strong acids and dyes. This group of buildings, like the drug building, is adjacent to the raw material and solvent storage.

In the first of these buildings, Cinchophen and other chemicals are made; the reactions are carried out in glass lined stills, the resulting compound, in the case of Cinchophen, phenylcinchonic acid, is blown over into a 500-gallon glass-lined crystallizing tank. The solid product is separated from the mother liquor by centrifuging and after further purification is dried in hot-air driers.

Another room of this building is chiefly used for the manufacture of local anesthetics such as Butyn, Procaine, Butesin picrate and Anesthesin. Again the principal reactions are carried out in steam-heated glass-lined kettles. The reduction of the mass takes place in steam-jacketed cast-iron pots with the aid of iron filings. In this process the crystals are centrifuged and after purification, dried in air driers.

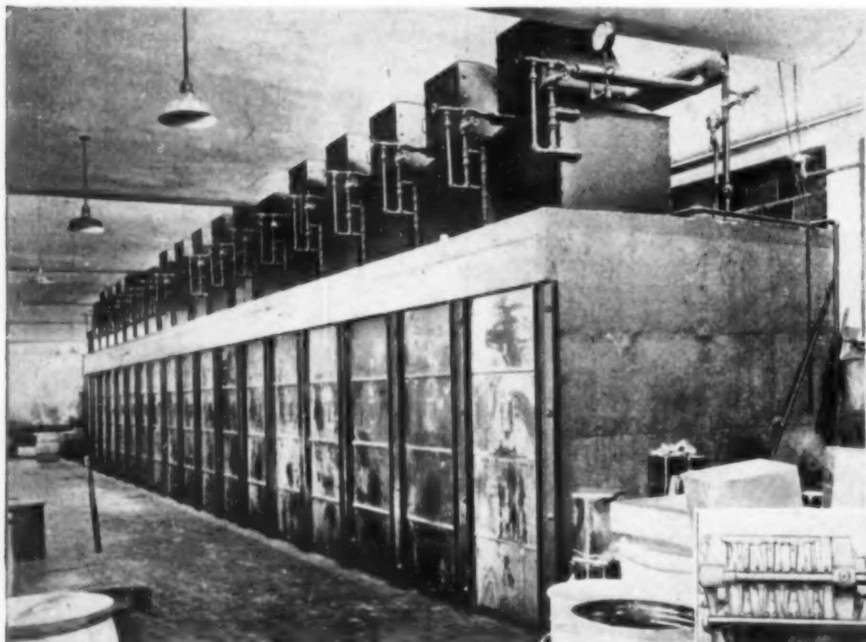
Barbital and similar products are manufactured in another building. The production of Barbital goes through a large number of steps, each demanding a separate kettle, some of the reactions requiring steam-jacketed kettles; two of the steps in the purification require oil-heated stills.

A third building is used for the production of Acriflavine. The first step in the preparation of this antiseptic is the making of proflavine sulphate which is filtered through bronze plate filter presses. This is then converted to acriflavine hydrochloride, which is distinctly acid in reaction, and is filtered on stoneware filters. On drying mechanically occluded hydrochloric acid causes trouble in the ordinary vacuum drier, consequently it is dried in an acid-resistant brick drier.

Like the products of the drug department the synthetic chemicals are sent to the control laboratories for assay, chemical and where necessary pharmacologic testing and then to the pharmaceutical department for packing and shipping.

Equipment Used in Manufacturing Neonal, Barbital and Other Hypnotics

Centrifugal, glass-lined kettles, steam-jacketed kettle and oil-heated still used in manufacture of hypnotics.



A Battery of Driers

The incoming air passes through the oil filters to be seen on the top of the drying chamber which removes the dust. Similar batteries are used for many of the chemicals.

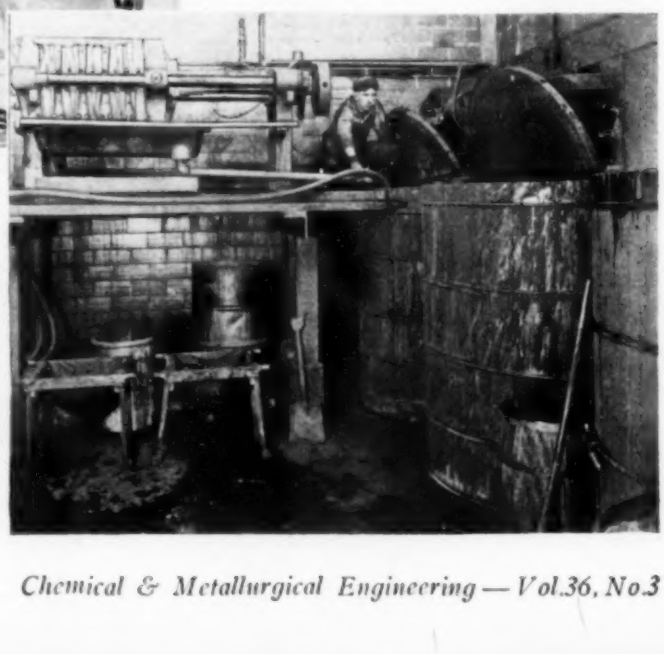
Effervescent salts manufacturing is housed in a two-story building. The salts are purified by crystallization on the second floor. The ingredients are then mixed, ground in a Shutz, O'Neil mill with a dustless receiver attached, sifted and poured into a chute from which the effervescent salts are bottled and packed for shipment on the floor below. The enormous bulk of these salts makes it advisable to do the bottling, packing and shipping here rather than in the pharmaceutical building.

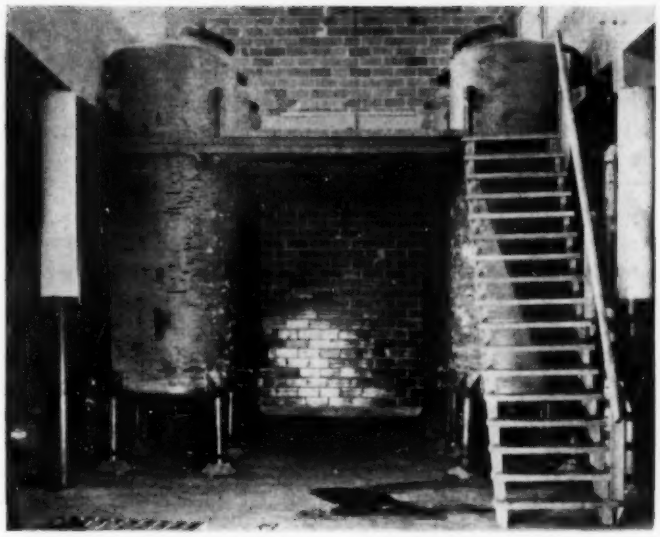
The storage for the raw materials, the granule, tablet, liquid, capsule manufacture and shipping are in a one-story building. The various operations are cleverly arranged.

Blueprints are made of the working formulas of all preparations

Where Acriflavine is Manufactured

The bronze filter press in the upper left-hand corner is used for filtering the proflavine sulphate.





Enameled Storage Tanks for Liquid Chemicals in Warehouse Building

manufactured by the Abbott Laboratories and kept in the superintendent's office. When it becomes necessary to make any of the formulas, the superintendent's office sends to the production department a copy of the blueprint with the amount of each ingredient calculated and put on the print. These blueprints or formulas are received by the foreman of the production department to which it is designated. The weighing-room attendant carefully weighs the exact amount called for on the print and places the ingredients for a particular formula together with the weights and compound name and order number in a container in the adjoining room where an inspector checks the weights. The ingredients are then ready for compounding.

In the preparation of tablets it is generally necessary to grind and mix the ingredients in ball mills. When making white tablets, porcelain-lined pebble mills are used, but when the color is of no importance cast-iron ball mills are often used. There is a large number of both kinds varying in size to provide for large and small batches. When grinding is not essential Rogers eccentric-drum mixers are used. In the case where the mass is moist or of a dough-like consistency the mixing is done in dough mixers with aluminum, copper or cast-iron linings as the case requires. During this mixing the filler and binder, which generally consist of starch and milk sugar, are added.

In order that the material will flow smoothly in the tablet compression machines it is usually necessary to granulate it. Therefore, the moistened mass containing the binder and filler is passed through rotary wet granulators. It is then spread on paper-covered trays in racks. These are rolled into the hot-air drier of which there are eighteen in this room. The incoming air passes through oil filters and is heated by circulating over steam coils in the top of the oven. Each rack is equipped with a thermometer which can be inspected through a window and the temperature controlled whenever necessary. Sylphon temperature regulators are employed.

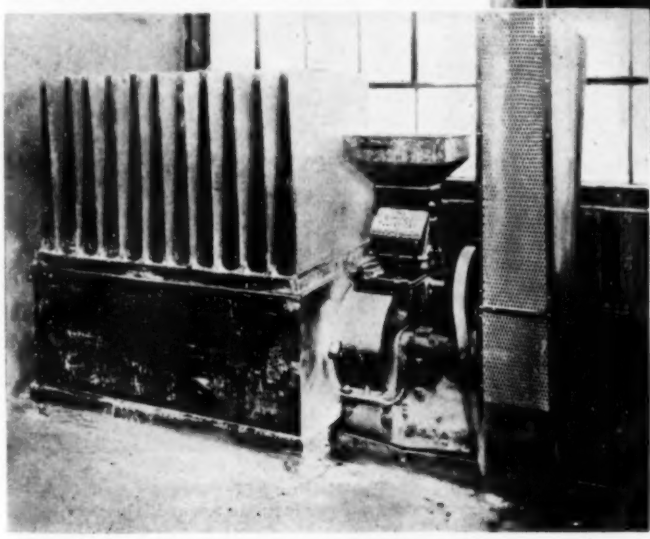
After the materials are dried to a suitable moisture content they are ground in Hance mills, and either sifted by hand or, when the batch is large, in Shutz, O'Neil Company gyration sifters. The dried granulated mass is then pressed into tablets by the multiple-compression machines, and individual rooms are provided for objectionable materials.

The tablets made by compressing the granulations are sent to the coating room, where the coating is applied in rotating copper-lined kettles. The tablets are then transferred into canvas-lined kettles where beeswax, carnauba or candelilla waxes are added and the tablets assume a high polish. To speed the coating and polishing operations each kettle of the battery is equipped at the opening with currents of both hot and cold air. The finished tablets are then bottled, corked, labeled, capped, inspected, and placed on a belt conveyor on which they are carried to the finished goods storage.

In the pharmaceutical department are also made the

Equipment Used in Manufacturing Synthetic Chemicals
Vacuum drier, glass lined stills and crystallizing tank, and other equipment for manufacturing Butyn, Procaine, Butesin, Butesin Picrate, and Anesthesin.

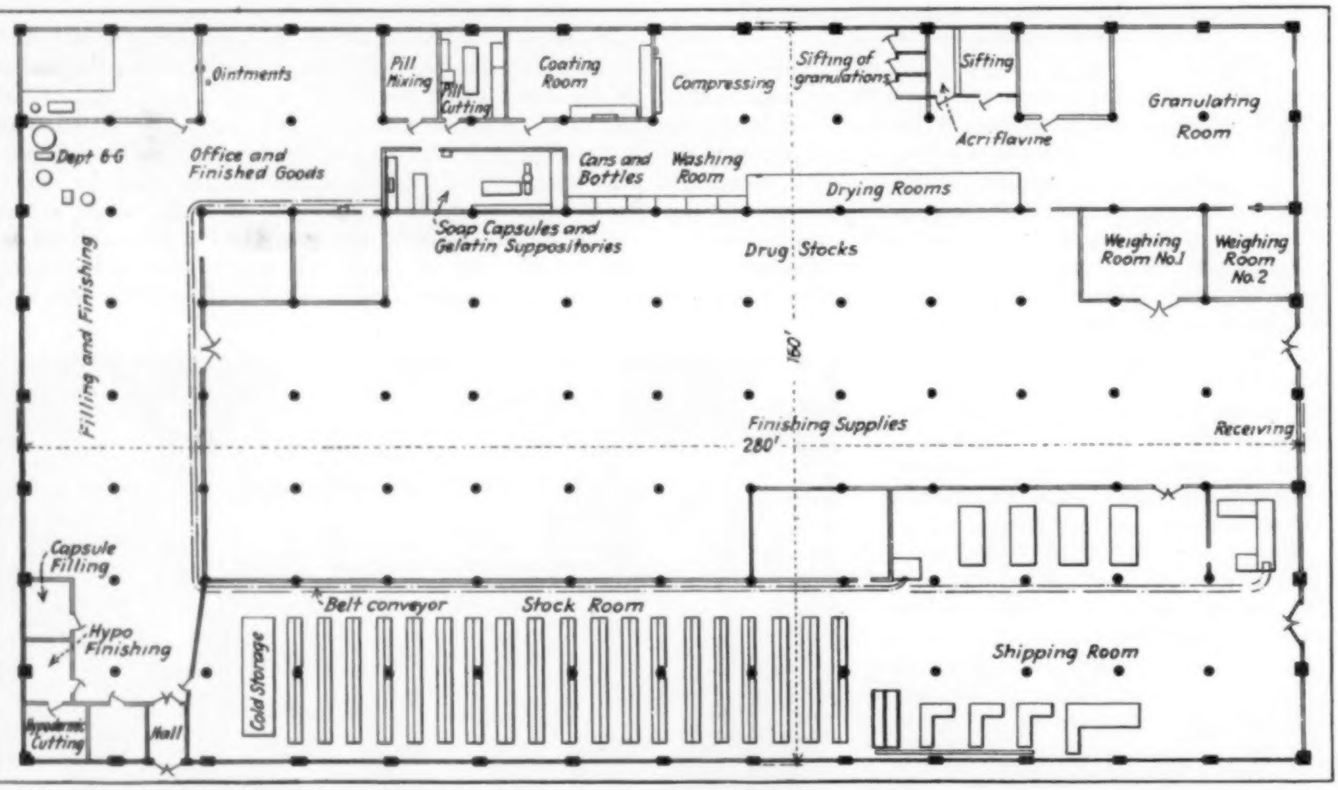
Grinder and Dustless Receiver for Ingredients of Effervescent Salts
Ground salts pass into the box receiver, permit escape of air and hold the dust keeping the atmosphere of the room clean.



Battery of Tablet Compressing Machines

adjacent department and is so divided and arranged that the materials that go into the tablet formulas are stored near by and the same thing for the other departments. The finished preparations of each of the departments after being put into cartons of a dozen or more bottles or jars are placed on the belt conveyor and taken to the storage for finished products. Here they are placed in their respective locations. The storage for empty bottles, cartons, etc., is convenient to the department using them and the packing material is stored adjacent to the shipping department which is next to the storage for finished products.

The impression one gets from visiting the Abbott Laboratories is that of an unusually well laid out and equipped fine chemical manufacturing plant, in which every means has been taken to assure pure products. The visitor is certain of receiving a most courteous and hospitable reception by the entire personnel to whom the writer wishes to acknowledge his gratitude, and in particular to E. H. Volwiler, chief chemist.

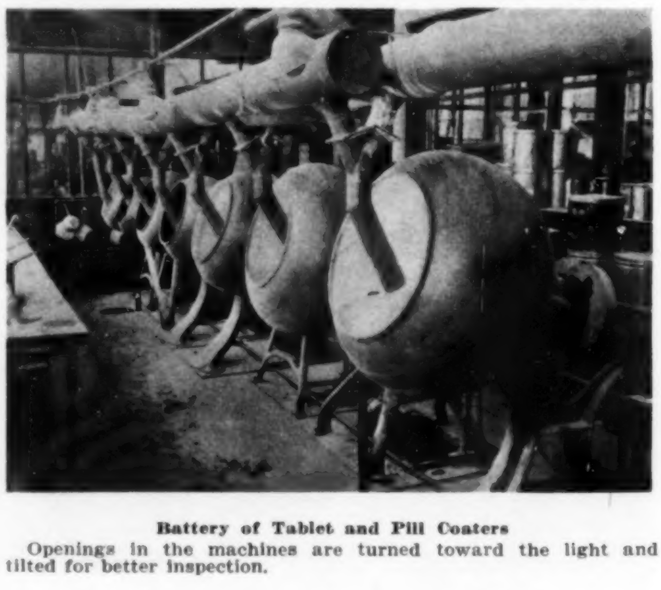


Floor Plan of Building Housing Pharmaceutical and Shipping Departments

The receiving and shipping platform are at the right-hand end of the building.

granules, capsules, suppositories, liquid preparations, medicated paraffin and ointments. The base for ointments is petrolatum, a semi-solid mass at room temperatures. The kettles for mixing the chemicals into the petrolatum are equipped with powerful stirrers and the jacket connected with the hot water and brine system. The ointment is then passed through a paint mill to remove the lumps and from the mill it goes into cylinders which are connected to the jar-filling apparatus. The jars are capped, labeled and sent to storage on the belt conveyor.

The accompanying diagram of the floor plan of the building housing the pharmaceutical and shipping departments give some idea of the convenient layout and arrangement of these departments. The receiving and shipping platforms are adjacent to the railroad siding; the receiving room houses the raw materials for the



Battery of Tablet and Pill Coaters

Openings in the machines are turned toward the light and tilted for better inspection.

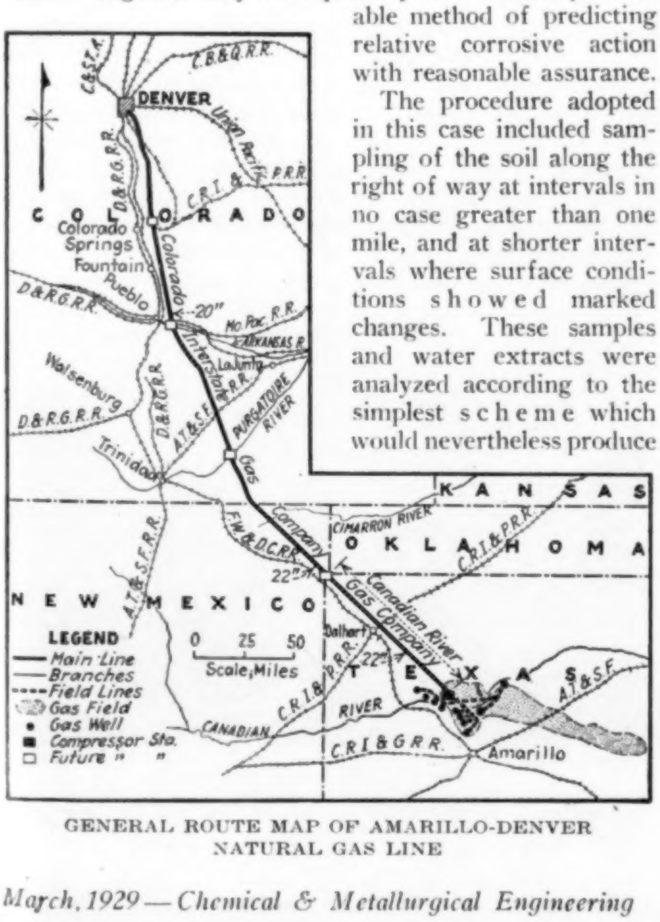
Soil Survey Cuts Cost in Preventing Pipe Line Corrosion

By Wm. Thompson Smith
Engineer, Ford, Bacon & Davis, Inc.

As A RESULT of a thorough investigation of the soil composition and topography a saving of approximately $200,000 was made in the cost of corrosion protection for the natural gas pipe line from Amarillo, Texas, to Denver, Colorado. Although the cost of protection as compared with the total cost of the project is small, still it is practically always large enough to justify a preliminary study as to the propriety of omitting coating in certain sections.

If pipe line protection is neglected early failure may result; if complete protection of highest grade is utilized, possibly unnecessary expenditures are made. Research to determine means of justifying a middle course should continue, but pending its completion, publication of partial results of investigation and of tentative conclusions would afford basis for avoiding ineffective expenditures. To have available the latest information, even if incomplete, allows the formulation of economic construction programs relating to protection upon firmer ground than opinion and guesswork.

Composition and topography are both totally inadequate for judging corrosion action in pipe line construction, when either is considered independently of the other. Together they offer possibly the best easily available method of predicting relative corrosive action with reasonable assurance.



GENERAL ROUTE MAP OF AMARILLO-DENVER NATURAL GAS LINE

The procedure adopted in this case included sampling of the soil along the right of way at intervals in no case greater than one mile, and at shorter intervals where surface conditions showed marked changes. These samples and water extracts were analyzed according to the simplest scheme which would nevertheless produce reasonably complete results. In general the relative activity of these soils upon steel has been confirmed by various laboratory tests, including, in particular, those suggested by the Bureau of Standards. And the estimation "excellent" of those of the samples which were apparently least corrosive was confirmed, with regard to the location from which these samples were obtained, by opinions of men experienced in pipe line construction.

Cleaning Steel Pipe
Before applying protective coatings to steel pipe, dirt, rust, and other foreign matter are removed. One of the methods employs a "saddle brush" which is built up from many ordinary wire brushes

As an example of the ratings based upon chemical composition the following table shows actual analytical results obtained for six samples from the Amarillo-Denver line, each representative of one of the six classifications used; namely, excellent, good, fair, poor, bad, and very bad.

Representative Analyses of Soil Samples
(Per cent by weight)

	Excellent	Good	Fair	Poor	Bad	Very Bad
Silt	40	20	0	30	10	30
Loss by ignition	5.1	2.7	3.2	5.3	7.6	20.7
Sulphur	0.22	0.06	0.15	0.11	0.26	0.59
Insoluble	89.9	89.8	86.5	82.3	78.0	44.3
Iron and aluminum oxides	3.7	3.5	7.2	4.2	9.0	11.1
Calcium oxide	0.9	0.8	0.7	2.4	2.8	20.4
Magnesium oxide	0.29	0.28	0.64	0.28	1.0	1.3
Water	7.5	7.5	6.25	8.75	7.5	7.5

Representative Analyses of Water Extracts of Soil Samples
(Parts per million)

	Excellent	Good	Fair	Poor	Bad	Very Bad
Total solids	64	151	405	320	692	3,333
Silica	10	15	210	35	25	13
Calcium	32	32	31	49	91	294
Magnesium	3	18	27	24	120	603
Iron and aluminum oxides	5	20	15	30	10	10
Sulphate	0	42	90	144	166	2,259
Carbonate	3	0	0	0	0	0
Bicarbonate	2	8	8	16	10	8
Chloride	0	9	21	15	260	127
Sodium and potassium	9	7	3	7	10	19

The hydrogen ion concentration for these six samples ranged from pH 7.8 to pH 8.3.

The analyses given are in themselves indicative of the

difficulty of assigning soil samples to their proper classes. While certain trends for some of the items are definite, the results for other items reported, when considered singly, appear inconsistent with the classification made. As a whole, these six analyses are very good illustrations of the necessity for basing any estimate of the corrosive effects of various soils on a consideration of all possible information rather than of some single item as sulphate content or hydrogen ion concentration.

The Amarillo-Denver natural gas pipe line is almost exactly 340 miles in length. 360 soil samples were considered. Based upon the chemical rating of these samples, the soil along the right of way was divided among the six classes in the following proportions:

Classification	Percentage
Excellent and good	16.39
Fair and poor	53.33
Bad and very bad	30.28

If chemical composition of the soil had alone been considered and it had been the object to lower protection costs where possible, "excellent" and "good" sections, or 16.39 per cent of the total length of line, would have been laid without coating. "Fair" and "poor" sections, or 53.33 per cent of the total length of line, would have received light protection, consisting probably of a single or perhaps two coats of some cold bituminous material. "Bad" and "very bad" sections, or 30.28 per cent of the total, would have been given the best protection available.

In revising the classification, as based simply upon chemical analysis, to make allowance for topographical conditions found by field inspection, the quality of protection specified was in no case lowered. On the other hand, in crossing drains, at dry washes, under dry creek beds, in sinks, in any locality subject to intermittent moisture and in cultivated land where the chemical analysis indicated the necessity of light protection, heavy was specified. Where, from purely chemical considerations, no protection appeared necessary, in moist soil light protection was specified. Pipe located in rocky or sandy soil, rated "excellent," or in very sandy soil, rated "good," was allowed no protection, if the ground formation gave evidence that it would be consistently dry. Pipe located in moist soil classified as "excellent" sometimes was not allowed protection although usually a light coating was specified. Pipe located in "good" soil, which was however moist, was given light protection. Pipe in any soil classified as "bad" or "very bad" from a chemical standpoint was allowed heavy protection, regardless of the moisture found or to be expected.

The consideration of topographical conditions along the above lines resulted in a revision of pipe protection specifications which, as compared with those resulting from chemical analysis alone, are as follows:

Protection Specified	Based Upon Composition Alone, Per Cent	Based Upon Chemical Composition and Topography, Per Cent
No coating	16.39	7.25
Light coating	53.33	42.29
Heavy coating	30.28	50.46

In the actual construction of the Amarillo-Denver line, it was found that light protection of the type chosen could be applied to 20-in. and 22-in. steel pipe at an average total cost, including material, labor and supervision, of something less than 15 cents per foot. Heavy protection could be applied at a total cost slightly less than 35 cents per foot. For present purposes, however, the approximate figures are used. The entire main line was 340.017 miles in length. Lacking some method for predicting, with some degree of assurance, the corrosive action to be expected at various points, the entire line would have been given heavy protection. The protection cost would have amounted to $1,848 per mile or a total of $628,350. As a result of the procedure outlined, heavy protection was specified for only 171.582 miles, involving a cost of $317,080. Light protection was specified for 143.804 miles, at a cost of $113,890. It was believed justifiable to lay 24.631 miles without protection of any sort. The total cost, therefore, of the protection specified amounted to $430,970 and represented a saving to the owners of the line of $197,380, over 30 per cent, a sum many times that which was expended for the work involved in making the saving.

Corrosion on Unprotected Dayton Couplings

These couplings were removed from a water line which failed after eight years' service. They had been buried in high, dry soil which, however, contained much alkali. The annual rainfall did not exceed 14 inches

This work was only a thorough-going attempt within practical limits, to use the knowledge so far gained concerning soil corrosion. It is not claimed that the prediction of corrosive action is possible with complete accuracy by this method or any other yet developed. Research may be expected to develop important, perhaps fundamental revisions in any method of predicting the degree of corrosion to be anticipated. But the engineer cannot wait for the exact and final answer.

Applying Bitumastic Primer

After cleaning the pipe is given a priming coat, usually by brush application. Where a hot final coat is to be used the function of the priming coat is to provide a bond between the pipe and its coating

What Michigan Offers the Graduate Chemical Engineer

Industrial Fellowships and Facilities for Post-Graduate Study in Chemical Engineering at the University of Michigan

By W. L. Badger

Professor of Chemical Engineering, University of Michigan, Ann Arbor, Mich.

THE PROFESSION of the chemical engineer is becoming so complicated that a four-year course is quite inadequate training for a man who hopes to hold positions of responsibility or to make any appreciable contributions in his chosen field. This is not an academic point of view, since the majority of requests which are made by employers are for men with graduate training. In recent years there has also been a noticeable demand for men with a Ph.D. degree in Chemical Engineering. It is a further healthy sign of the conditions in the profession that employers are, in general, willing to pay larger salaries for men with these advanced degrees. Accordingly, a prospective student may look on postgraduate training as an investment which will return to him many times its cost during his first five years out of school.

Fig. 1—General View of Unit Process Laboratory

Still columns, storage tanks and miscellaneous equipment are in the background. The centrifugal is in the foreground. One end of the Swenson-Walker crystallizer is at the extreme right edge.

The Department of Chemical Engineering at the University of Michigan has recognized this trend for some time and has been shaping the work it offers to meet this demand. The ordinary four-year undergraduate course is designed so far as possible to give a man a sound foundation and also a broad view of his profession, but it is impossible to accomplish any specialization in a four-year course. At the same time, many men can finish this four-year course and at the end of it secure positions of usefulness and interest, although they cannot hope for as rapid promotion as men with graduate training.

The four-year course includes the usual foundation in mathematics, physics, chemistry, mechanics, modern language, English, the elements of mechanical and electrical engineering, and basic courses in chemical engineering. These basic courses include a general survey of engineereing materials, a more detailed study of the properties of metals, a general survey of the unit operations, and a discussion of the more important inorganic and organic chemical industries. This does not deviate much from the courses generally offered in chemical engineering, except in the emphasis which is placed on unit operations.

Metallurgy has always been a part of chemical engineering at the University of Michigan, although the emphasis has been placed on the working of metals rather than on the extraction of metals from their ores. In the last year of undergraduate work a man who is interested in metallurgy deviates somewhat from the course outlined above, but he is distinguished mainly by the fact that he chooses his thesis problem in a metallurgical subject.

For many years one important feature of the undergraduate work in this department has been the thesis. It has been considered that if a chemical engineer is to accomplish anything in his profession it will be by solving new problems. Based on this point of view, the department has not offered many laboratory courses involving fixed sets of experiments, but has always laid considerable emphasis on the thesis. It is not expected that the average undergraduate can uncover any appreciable amount of new information; but he can take a problem, review the literature, plan experimental work, design apparatus and, in general, learn the technique of research work, even though he does not go much farther.

Since the undergraduate thesis has been of prime importance for many years, it was natural that graduate work developed early at the University of Michigan. The principal growth along these lines has come since the War, and at present there are 41 graduate students enrolled in the Department of Chemical and Metallurgical Engineering, of whom 23 already have the Master's degree and are working for the Doctorate. The work of these graduate students follows naturally along the lines of the undergraduate courses.

Chemical engineering as we view it, is really based more on mathematics and physics than it is on chemistry; therefore the graduate students generally do not take

courses in chemistry unless they are especially interested in the chemical rather than the engineering side of the profession. On the other hand, practically all of them take advanced work in physics, mathematics, and thermodynamics, advanced courses on the unit operations, some advanced courses relating to specific industries, and considerable research work. A candidate for the Master's degree usually accomplishes something definite in the way of results from his research; and the candidates for the Doctor's degree are, of course, held to the standard of making some definite contribution to knowledge.

The importance of postgraduates work, both from the standpoint of the results obtained from the investigations and from the standpoint of supplying especially trained men for the industries, is emphasized by the number of industrial fellowships which are available. During the school year of 1928-29 there are available the following: the Michigan Gas Association fellowship, two fellowships from the American Gas Association, the Swenson Evaporator Company's fellowship, four fellowships of the Natural Gasoline Association of America, the Thomas Berry Memorial fellowship for the study of varnishes, and two fellowships from the Michigan Geological Survey. Most of these fellowships pay $750 a year and tuition. In addition to these there are a number of assistantships paying various smaller amounts, and there is work in the laboratories by the hour on research projects which are financed from the outside. It is not definitely known how many of these fellowships will be available during the school year 1929-30, but there will probably be at least as many as are available this year.

The preceding discussion of the importance assigned to thesis problems and research work gives a clue to the type of equipment to be found in the laboratories. For the undergraduates, one laboratory course is required

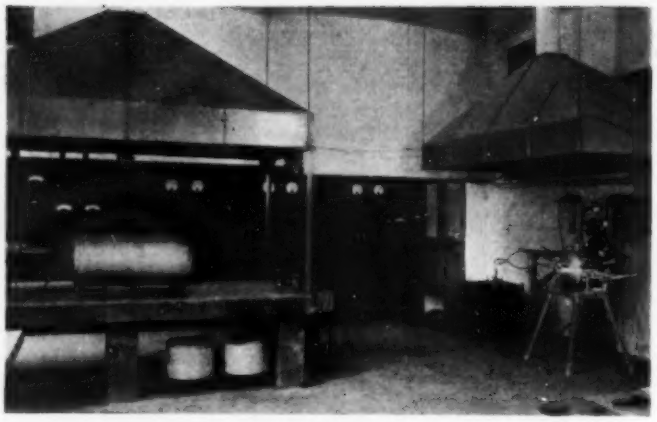


Fig. 3—Electric Furnace Laboratory

which accompanies the beginning course on the unit operations. There is no equipment provided for this course exclusively, but a wide variety of experiments can be planned by utilizing the special equipment which has been developed for research work. The experiments in this course cover such items as the calibration of an orifice and a flow meter, the testing of reciprocating and centrifugal pumps, heaters, evaporators, filters, stills, crystallizers and driers.

An important feature of this course is that the apparatus is usually not completely set up for a test, so that the students must do some piping and alterations as they would if they were testing a piece of apparatus in a plant. Part of this general unit process laboratory is shown in Fig. 1. This shows the centrifugal in the foreground. One end of the Swensen-Walker crystallizer is at the extreme right edge. Still columns, storage tanks and miscellaneous equipment are in the background. It has never been the policy of the Department to collect a museum of miniature chemical equipment by which standardized experiments would be done in a routine manner.

Most of the equipment of the laboratory has been installed with the needs of undergraduate thesis work and advanced research students in mind. So far as possible, this equipment has been large enough so that the results may be directly used in the design of actual plants, and at the same time care has been taken to provide flexibility and accessibility to meet the demands of research work. The lines along which the department is specially well equipped follow, in general, the division of chemical engineering into unit operations rather than along the lines of specific industries. The evaporator laboratory is especially well equipped, and is the most complete and extensive in the country. Crystallization also represents a research program and several types of crystallizers are available. There is some equipment for the study of heat transfer, but this is not so elaborate as some of the more specific applications of heat transfer. The laboratory possess several still columns with all the necessary accessories; filter presses, air conditioning apparatus, experimental driers, centrifuges, tanks equipped for the study of stirring and mixing; and special designed experimental screens. The extent and flexibility of this apparatus is partly illustrated in Fig. 1, but more particularly in Fig. 2. This shows one of the experimental evaporators with a few of its connections. Along the lines of specific industries, there is also some special equipment. At present electroplating, petroleum refining, and the paint and varnish industries are best represented; although it is planned in the near future to add

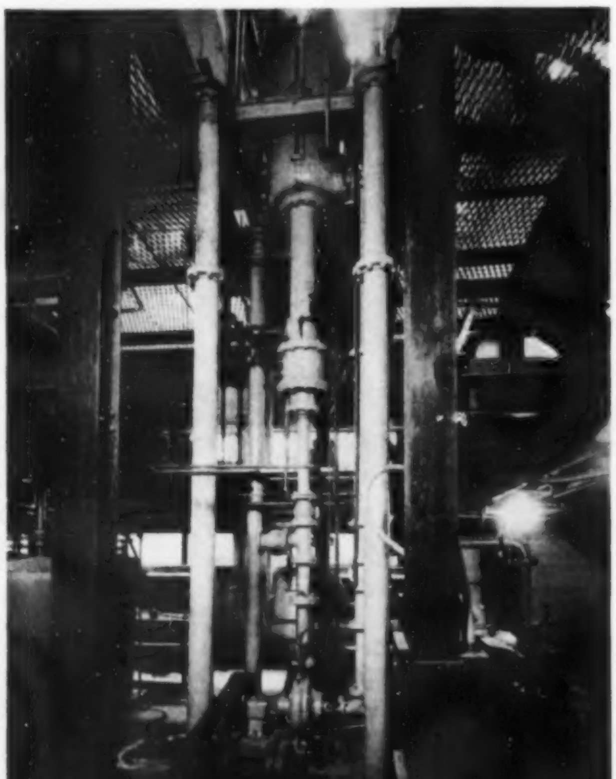


Fig. 2—Model Forced Circulation Evaporator
One of the experimental evaporators with a few of its connections.

special equipment for research on pulp and paper manufacture. An especially complete laboratory is available for the study of motor fuels and their application to various types of automobile engines.

The metallurgical department has special equipment for carrying out all kinds of heat treating operations in both gas fired and electrically heated furnaces. There is also special equipment for the study of metals at high temperatures. The University's forge shop and foundry are located in the same building with the Department of Chemical Engineering, and their work is closely coördinated with the work of the metallurgical division. Fig. 3 illustrates one of the metallurgical laboratories containing electric heat-treatment furnaces, and it shows in the background a switchboard for electric furnace work.

This list mentions typical apparatus which may be looked on as more or less permanent equipment. Much of the research work by both undergraduates and graduates necessitates building special equipment for the individual programs. Space is available for such set-ups, and the department has a well equipped shop with two mechanics who give their full time to the Department. An ample supply of pipe and fittings and other necessary materials are carried on hand in the building at all times.

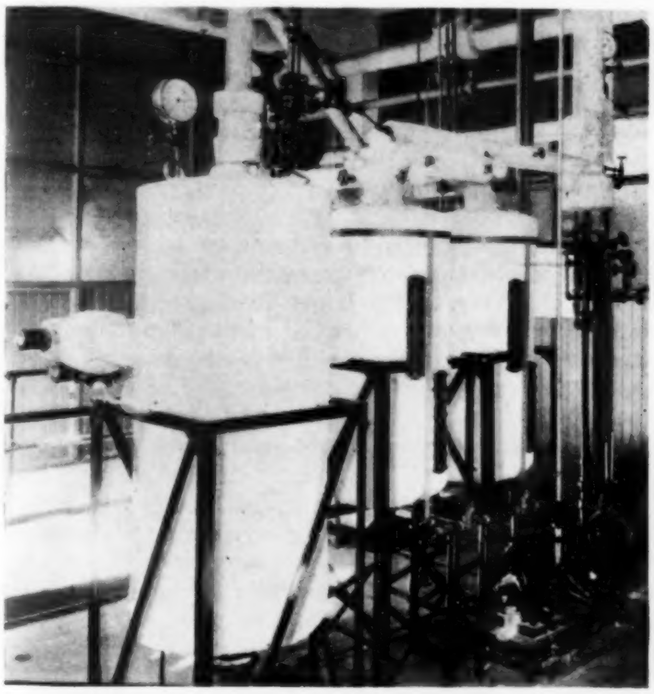


Fig. 4—A Special Set-Up for Fellowship Work
Part of one of the special set-ups for high temperature evaporation. This has been built for the use of one of the holders of fellowships.

Fig. 4 shows part of one of the special set-ups for high temperature evaporation. This has been built exclusively for the use of one of the holders of fellowships.

In addition to special apparatus, there are storage tanks, pumps, transfer lines, platform scales and measuring devices. Most of the apparatus for studying the unit operations is so inter-connected that general processes involving several operations, such as evaporation, filtration and crystallization, can be carried out. As a matter of fact, if desired, the laboratory may be operated as a complete chemical plant using large quantities of material and turning out products in ton lots.

Editor's Note.—*The graduate work of the Department of Chemical Engineering is described in a bulletin which has just been published, copies of which may be obtained by writing to the Department.*

British Coal Hydrogenation Results Reported

RESULTS of extended experimentation on coal hydrogenation carried out by the British Fuel Research Station were summarized by C. H. Lander speaking before the Royal Society of Arts in London Feb. 4. The possibility of producing from 110 to 130 gallons of distillable oil per ton of coal processed was indicated. The process consists in general of adding hydrogen chemically to the coal substance by reaction at high pressure and elevated temperature under controlled conditions. An abstract of Lander's presentation reported in the *Gas World* (London) is as follows:

A problem of considerable difficulty was that of introducing a solid material such as coal into a vessel containing hydrogen under a pressure of 200 atmospheres. Bergius had solved this by mixing ground coal with a liquid organic vehicle so as to form a paste which could be pumped by special appliances. To this mixture was added a small proportion of iron oxide to act either as a catalyst or as a means of removing sulphide of hydrogen in the gases evolved. In the continuous type of plant used at Mannheim and at the Fuel Research Station, three reaction vessels or bombs were used in series, the first being maintained at about 460 deg. to 480 deg. C., and the two final ones at about 490 deg. C. The exact temperatures required in the final bombs were somewhat critical and depended on the type of coal used. The product leaving the last bomb was cooled, and its pressure reduced in two stages, firstly to 60 atmospheres, where the gas evolved was scrubbed with oil in order to extract motor spirit, and secondly to atmospheric pressure, where the final crude product was collected.

The final crude product contains the whole of the inorganic matter of the coal, together with the added iron oxide and a certain amount of partially converted solid material. These solids have to be removed before distillation can be effected. A typical example of the yields per ton of coal obtained in the continuous plant (one ton per day) at the Research Station is as follows:

Yields Per Ton of Coal
(Hydrogen consumed = 114 lb.)

		lb.
Fraction	0 deg. — 175 deg.	= 83
"	175 deg. — 230 deg.	= 208
"	230 deg. — 270 deg.	= 197
"	270 deg. — 310 deg.	= 105
"	310 deg. — 360 deg.	= 208
	Pitch	= 329
Gas Benzine		= 42
Bergin Gas		= 325
Unconverted Coal		= 363
Water		= 179
Coal Ash		= 161
Loss		= 154
		2,354 lb.

It would appear that the chief value of the fractions from the hydrogenation of coal would be either as a motor spirit or as fuel oil.

The hydrogenation plant at the Fuel Research Station was also used to investigate the exact part played by the hydrogen in converting the coal into oil, and coal had been fractionally hydrogenated.

The phenomenon is being investigated from a number of angles, but it is not yet possible to explain fully the exact mechanics of the reactions. Although probably of great importance in the future, the process of hydrogenation, at any rate, so far as the bituminous coals of this country are concerned, is not able to make oil as yet at a price anywhere near that of the cost of similar fuels obtained from natural sources.

Chemical Engineering Problems Discussed at TAPPI Meeting

Editorial Staff Report

THE INCREASE in number of members attending the fourteenth annual meeting of the Technical Association of the Pulp and Paper Industry at the Waldorf in New York City, February 19-21, was proof of the growing interest in the scientific aspects of the industry by the pulp and paper manufacturers. During the past year the names of some 200 technical men and of 14 organizations were added to the membership list. The meeting was attended by engineers and chemists from all parts of the country and the corridors and committee rooms were filled with men discussing the problems of the industry.

One of the points of greatest interest in the meeting was the paper by H. G. Rappolt and A. E. Montgomery, engineers for the J. O. Ross Engineering Company, on the Ross-Grewin high pressure vapor removal system for paper machine driers. This system makes use of high pressure air jets entering alternate vapor pockets from the front and back sides of the machine. The system consists essentially of a small positive pressure blower for compressing the air to the desired pressure, heating coils, and a system of headers, drops and nozzles. The nozzles are specially designed to deliver a small diameter jet of heated air at high velocity into the vapor pocket.

At the wet end, where the sheet is delicate and likely to be broken by a strong air current, a special blast pipe with adjustable air ports is used by which the velocity of the jet of air can be closely regulated. Dampers are provided in the distributing headers so that any section of the driers can be favored. Usually, more air is concentrated at the second quarter from the west end, as that section generally evaporates the most water.

Another interesting paper on the same problem, was that presented by T. K. Sherwood, assistant professor of chemical engineering, Worcester Polytechnic Institute, on the "Mechanism of Drying of Pulp and Paper." Sherwood limited his discussion to the common steam-heated drum or "can" drier process, in which the sheet of pulp or paper is heated by contact with rotating hollow drums filled with steam. The author pointed out that all very wet solids being dried under constant drying conditions exhibit a "constant rate period," during which the rate of drying is fixed. The rate does not continue constant until the solid is dry, but at some definite water content called the "critical water content," the rate of drying starts to decrease and the range from there to dryness is called the "falling rate period."

Corrosion in the pulp and paper industry was ably discussed in papers by I. R. McCall on the "Corrosion in Paper Mills," and by J. A. Matthews on "Corrosion Resistant Steels." The former treated the problems that confront the maintenance engineer in so far as corrosion is concerned and pointed out that one of the most valuable assets a paper mill organization can have is a man who makes numerous careful inspections of the mill and insists continually on the cleaning, painting and treating of the steel and iron surfaces affected. McCall emphasized the importance of proper painting at the time of construction, that the surface should be thoroughly cleaned and dried, and that the proper type of paint material be used.

Another paper in which there was much of interest to the chemical engineer was that on "Handling Materials in the Paper Industry" by George D. Bearce, engineer, International Paper Company, in which the author states that almost every type of mechanical handling equipment is used in pulp and paper mills. New plants are especially designed to minimize the handling of all materials, both raw and finished products, and thus lower the cost. Each plant whether it is a new one or one that has been in operation many years, presents a wide diversity of handling problems, each of which must be analyzed and solved. Although there are fundamental principles involved in handling any commodity, it does not follow that equipment suitable in one plant will be equally successful in another plant for the same commodity.

Other papers in which lively interest was manifest in the discussion were those by Linn Bradley and Edward P. McKeefe of the corporation bearing their name. The Keebra process described by them produces pulp from woods by utilizing a digesting liquor containing sodium monosulphite as one of its main chemical constituents; Royal H. Rasch, research associate at the Bureau of Standards, for the Brown Company spoke on "Quality of Purified Wood Fibers." He dealt with a study of the more important chemical and physical properties of papers and paper-making fibers and the effect of accelerated aging tests on these properties.

The committee reports showed how wide awake the industry is to the possible solution of its problems by technical research and development. The committee on training men for the industry recommended through its chairman, Allen Abrams, that a paid educational director, properly supported by a committee and individual assistance be appointed to handle the program. B. W. Scribner, chairman, of the Paper Testing committee reported that two additional official methods proposed by the committee were adopted. These are determination of gloss and capacity. The total number of completed methods is now twenty-six. A method of determination of bulk has been formulated and submitted for the vote of the association.

The social highlight was the annual dinner February 20 at the Commodore. Departing from the usual custom, the ladies were invited and the affair took the form of a dinner dance. Howard C. Parmelee, editorial director of the McGraw-Hill Publishing Co., and secretary of the American Institute of Chemical Engineers, delivered the principal address, choosing for his subject: "What is Ahead for the Technical Man." "We must expose ourselves to growth by investigation and research, and sound economic worth must be the aim of all research. The carrying of methods of science into business is what is ahead for the technical man who is particularly fitted for the executive position," Dr. Parmelee emphasized. Dr. Gill Robb Wilson, past chaplain of the American Legion spoke on the social revolution.

Officers elected for the ensuing term are: president, P. H. Glatfelter, P. H. Glatfelter Company; vice-president, Maximilian Krimmel, Hammermill Paper Company; secretary and treasurer, R. G. Macdonald. W. O. Johnson, Strathmore Paper Company, and Ralph A. Hayward, Kalamazoo Vegetable Parchment Company, were elected to the executive council for one year; and R. H. Laftman, Bogalusa Paper Company, John S. Bates, Price Bros. & Company, Ltd., and Robert Bell-Irving, Powell River Company, Ltd., were elected for three years.

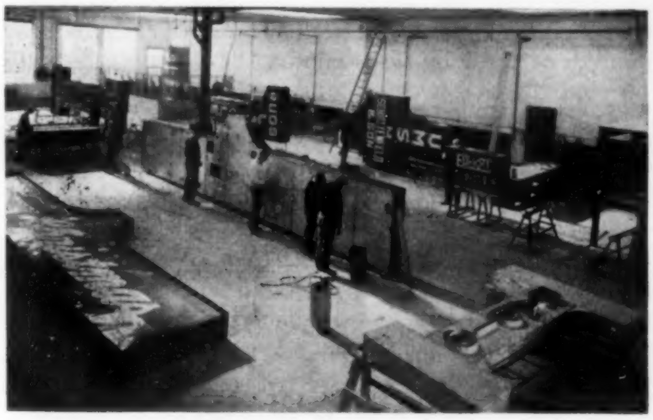
Highly Developed Technique Required to Purify Gases for "Neon" Signs

By Joseph Henry O'Neil
Claude Neon Lights, Inc.
New York, N. Y.

A FEW YEARS ago it seemed impossible that a gas so rare that only one part occurs in every ten thousand parts of air could have the effect on advertising that has developed through the better knowledge of the properties of neon gas. The most obvious results of the development of neon, argon, and helium are glowing colored tube electric advertising displays and signs that dot the avenues of all the larger American cities.

In 1912 the first neon electric display was introduced in the Grand Salon in Paris. But it has not been until recent years that this application of neon has become practical.

This first light had a very short life, but it was soon found that the very small amount of impurities in the gas caused the occlusion of the neon, and that in order to increase the life of the tube so it would be sufficiently long for practical purposes it was necessary to purify the gases and to increase the surface of the electrode area in proportion to the amount of current it carried. From this point on their development has been rapid.



Assembly Room
A section of the shop in the Claude Neon plant where the finished tubing is attached to metal signs

These gases occur in exceedingly small concentrations, neon —0.001 per cent, argon —0.93 per cent and helium —0.0005 per cent. This readily indicates to those who are familiar with gas extraction processes that their extraction from the air requires a highly developed technique.

They are customarily recovered as a part of the process of the rectification and separation of air for the production of oxygen and nitrogen. A review of the critical data on these gases will make it apparent that the neon and helium content will be found in that portion of the apparatus in which the nitrogen concentrates, whereas, the argon will follow more closely with the oxygen fraction. There are a large number of entirely practical cycles for increasing the concentration of these gases above that at which they are found in the air liquefaction apparatus.

Fundamentally, however, they all depend upon the difference in boiling points and vapor pressures of the component which it is desired to remove from the remainder of the mixture. For example, the mixture of neon, helium and nitrogen is withdrawn at the point where it is found in greatest concentration and subjected to additional refrigeration which causes a portion of the nitrogen to condense and thereby increases the percentage of neon and helium present in the gas phase. When this process has been continued as far as it is practical, the mixture of neon and helium is then subjected to a charcoal absorption which permits the two rare gases to be selectively cut off.

A Section of Claude Neon Plant
Glass tubes being shaped over an asbestos pattern to desired letters and designs for advertising display

The fundamental basis of the recovery of argon is identical except that this gas is found in close proximity to the point in the apparatus occupied by the pure oxygen. In this instance, therefore, the material which must be subjected to additional rectification will be a mixture of argon and oxygen with a slight trace of nitrogen. The use of a low-temperature refrigerant causes additional quantities of the oxygen to condense and hence a gradual concentration of argon and nitrogen in the gas phase. In order to purify the argon one of the commonest methods of procedure is to remove the oxygen by passing the mixed gases over hot copper and then to remove the nitrogen by passing the resultant argon ~~oxygen~~-nitrogen mixture over calcium carbide.

For the purpose of advertising displays, the gases are inclosed in glass tubes containing an electrode at each

end, the gas acting as conducting medium. The electrodes are cylindrical in shape and made of copper. A lead glass is generally used for the tubing, since it is easiest to work. After the tubing has been bent into the desired design and the electrode sealed in it is evacuated as far as possible with Langmeir and Eisler pumps. To drive all air out of the electrodes and walls of the glass tubings the electrodes are bombarded by means of a current of 16,000 volts. This is repeated three times to remove the last traces of air, which must be absent before introducing the gases.

The tubes are then cooled to room temperature and the gases are introduced. The introduction of the gases is accomplished by sealing the tubes in a line in which are the reservoirs of neon, helium or argon and a pressure gage. The gas or gases depending upon whether a single gas or a combination of gases is desired, is or are then allowed to flow into the tube until a desirable pressure is obtained. The pressure varies with the different gases, in the case of neon a final pressure of over $7\frac{1}{2}$ mm. is used while twice that pressure is desired in the case of other gases.

The tubes are then removed from the line and further purified by "aging." This process consists of applying a low voltage and requires from five or ten minutes to twenty-four hours, depending upon the length of time required to bring an entire tube to a uniform color. It is at this point that the mercury is added if desired and distributed throughout the length of the tube. The tube is then ready to be put in place on the metallic framework of the sign.

The various colors are obtained by using individual gases, combinations of gases and mercury vapor, and colored glass. Almost any color and tone can be produced by these means. The colored glass most generally used is a yellow lead glass. The most generally used of all the colors is the orange red, which is a white glass tube containing neon, yellow or golden is yellow glass containing helium, green is the yellow glass tube containing neon and mercury vapor, blue light is secured primarily from vaporized mercury, mixed with either neon, argon or some other gas. Lavender, white lights and other shades are possible from mixtures of various rare gases.

Since the test by the British Government in 1925, which resulted in adoption of neon tubes for aeronautical beacons, neon has played an important part in the progress of aviation. The greatest factor in the value to aviation is the penetration of fog which is the dread of all aviators. A neon beacon on the ground will penetrate a fog running over 1,500 ft. in height, and causing the surface of the fog above the beacon to glow with a pinkish tint marking the location of the landing field beneath. The distance from which neon beacons have been seen from the air has become almost proverbial. The development of the neon light has also made possible indirectly a great many other inventions which use a light screen of neon tubes—namely, the television, wireless telephone, telephoto, talking movies, etc.

Adhesion Between Solids Shown Specific in Nature

By E. R. Rushton
Department of Chemistry, Cornell University

IT HAS been known for some time that the amount of a gas taken up or adsorbed by the surface of a solid varies with the nature of both substances; this seems to indicate that the attraction between them has something of the specific nature of chemical affinity, although they can not be regarded as forming true chemical compounds. Some recent experiments by a number of English physical chemists show that the force of adhesion, measured by the pull necessary to break a joint, is likewise specific for the substances involved.

The technical use of adhesives involves the joining of two solid surfaces by means of a liquid film that solidifies on standing. McBain and Hopkins (*J. Phys. Chem.*, pp. 188-204) found that they could join solid surfaces by causing water, sulphur and a number of other pure substances to solidify between them and they concluded that "any fluid that wets a particular surface and is converted into a tenacious mass by cooling, evaporation, oxidation, etc., may be regarded as an adhesive for that surface."

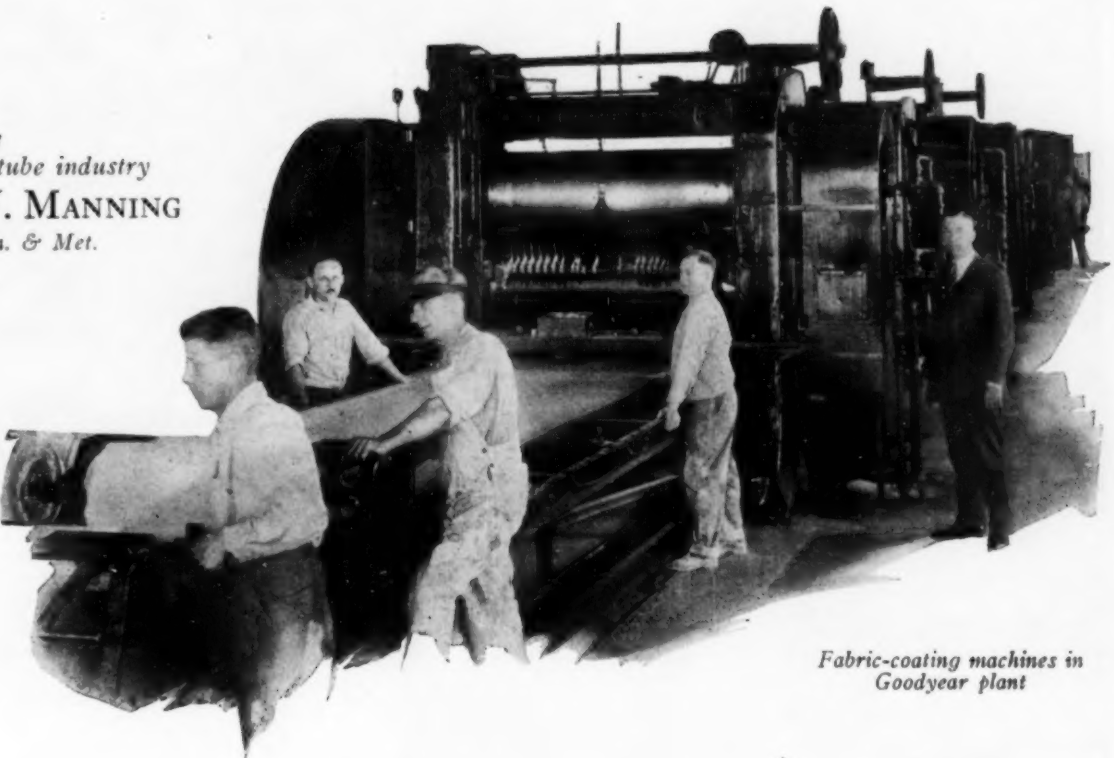
These investigators also found that the thinnest films of adhesives made the strongest joints and that these joints are much stronger than an equal cross-section of the pure adhesive.

McBain and Hopkins also found that with certain adhesives the strength of the joint is directly proportional to the tensile strength, elasticity and hardness of the solid substances between which the joint is made—additional evidence that the action at the surfaces is specific. This has been confirmed by Hardy and Nottage (*Proc. Roy. Soc.*, London, pp. 62-76, 1926) for joints between metal surfaces made by allowing pure organic substances to solidify between them. They found that the joint between two steel surfaces was stronger than that between two copper surfaces when both joints were made with the same material. However, when the same substance was used to join copper and steel, the break always occurred very close to the copper surface, but the strength of the joint was found to be the mean between the strength of the steel joint and that of the copper joint, which would presumably be the strength of the weaker link. They concluded that the attractive force of the steel must extend through the solid layer of pure organic substance, in order to affect the strength of the joint at the copper surface.

Their experiments also show that when such joints are broken the break does not occur immediately at the metallic surface, but that a thin layer of the adhesive substance is left which cannot be detected by the microscope, and is known to be present only by its effect on the specific friction of the metallic surfaces. They believe that this film is only a few molecules thick at most, and is held so firmly by the metallic surface that its molecules are oriented, that is, they are all arranged in the same direction. These views are strikingly confirmed by Trillat's work (*Ann. phys.* 10, 6, p. 5) on the X-ray patterns of oily liquids placed on solid surfaces. He concludes that the first layer of the liquid at the surface of the solid is three molecules thick for palmitic acid and that it is so strongly held by the solid that its molecules are regularly spaced like those in a crystal, but that beyond this primary layer the structure is confused and non-stratified, although still affected by the nature of the solid surface for some distance.

From the experimental evidence it appears that adhesion is due to a specific attraction or tendency toward interaction at the surfaces which has something of the specific nature of chemical action.

A description of the California tire and tube industry
By Paul D. V. Manning
Assistant Editor, Chem. & Met.
San Francisco, Calif.



Fabric-coating machines in Goodyear plant

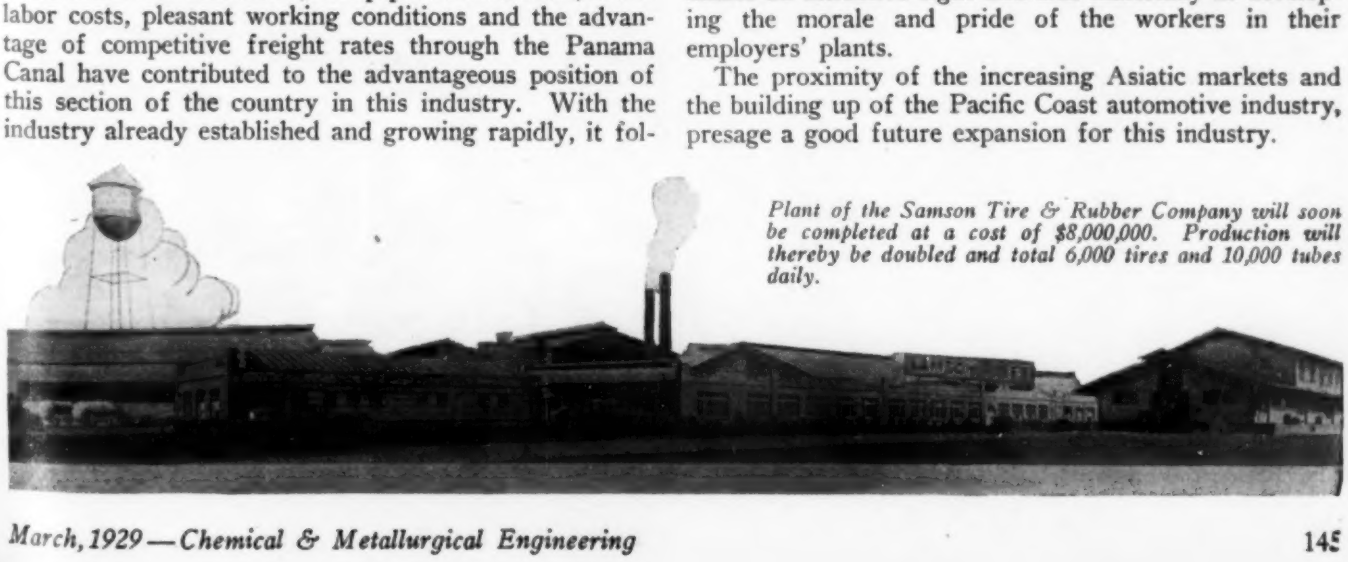
Pacific Coast Economic Conditions Attract Tire Industry

WITH WORK begun on building of its fourth large tire plant, Los Angeles, California, looks forward to being the second tire-producing center of the country. The large western states market and possibilities in future trans-Pacific trade which were most attractive incentives in the establishment of this Pacific Coast industry, have been augmented by business in competitive eastern markets because of low-cost water transportation.

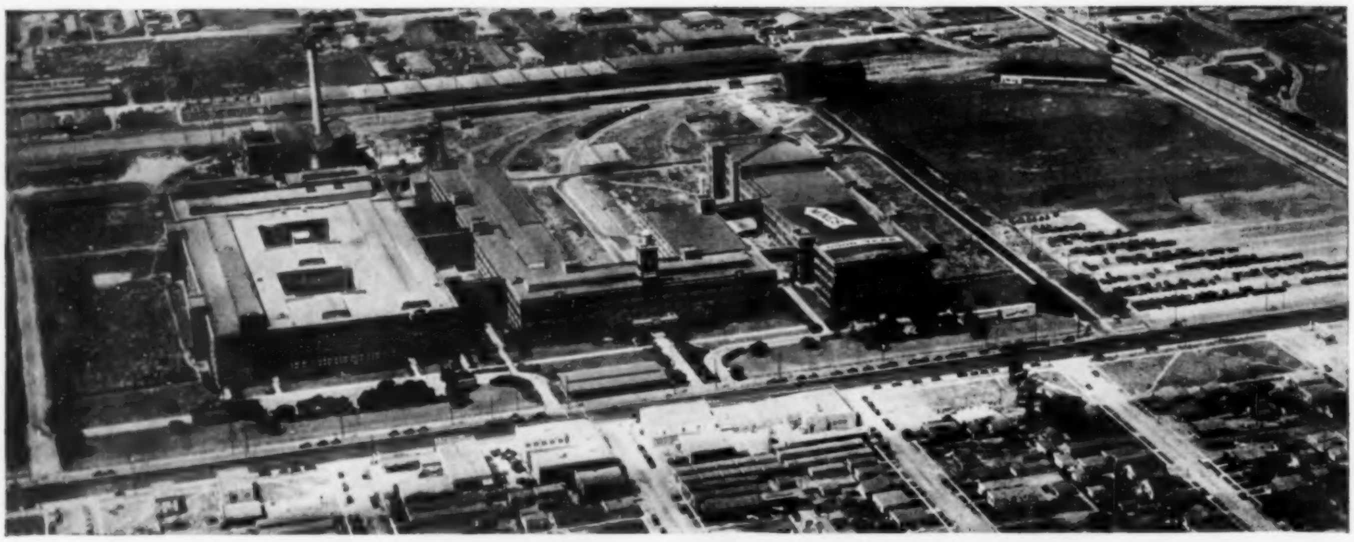
Direct all-water shipments of raw materials, present growth and development of the cotton-growing industry in Arizona and California, cheap power and fuels, lower labor costs, pleasant working conditions and the advantage of competitive freight rates through the Panama Canal have contributed to the advantageous position of this section of the country in this industry. With the industry already established and growing rapidly, it follows that there will be a marked growth in such allied industries as textiles and rubber reclaiming.

With the new Samson plant in operation, daily production of the factories of this Company, Goodyear, Goodrich, and Firestone will be in excess of 25,000 tires and 40,000 tubes. Each manufacturer is using the most recent equipment and efficient methods. Architectural beauty and fitness has been kept well in mind in the design and construction of the buildings and the plants are well arranged and clean. Shrubbery aids in giving a fine appearance to the buildings and grounds. This makes an attractive sight and aids materially in developing the morale and pride of the workers in their employers' plants.

The proximity of the increasing Asiatic markets and the building up of the Pacific Coast automotive industry, presage a good future expansion for this industry.



Plant of the Samson Tire & Rubber Company will soon be completed at a cost of $8,000,000. Production will thereby be doubled and total 6,000 tires and 10,000 tubes daily.



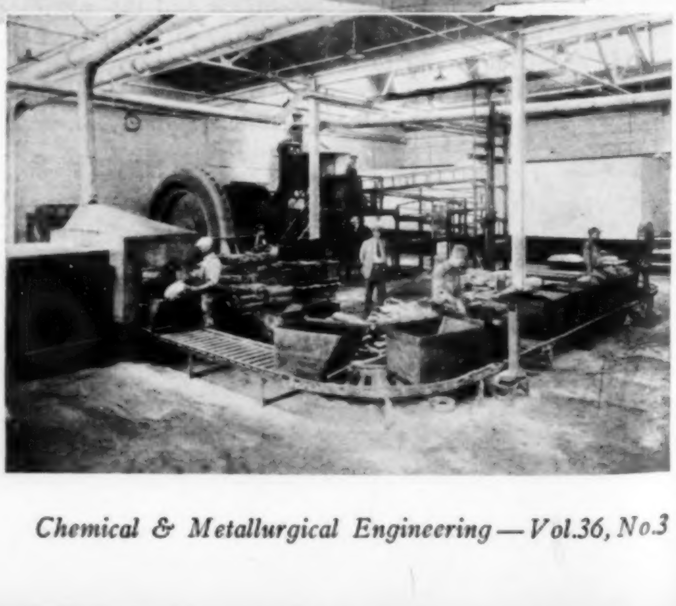
Goodyear plant began production in 1920. It has a floor space of 33 acres, the investment totals about $15,000,000 and there are employed about 3,000 workers. The rated capacity of this plant which is a daily production of 10,000 tires and 15,000 tubes is now being exceeded.

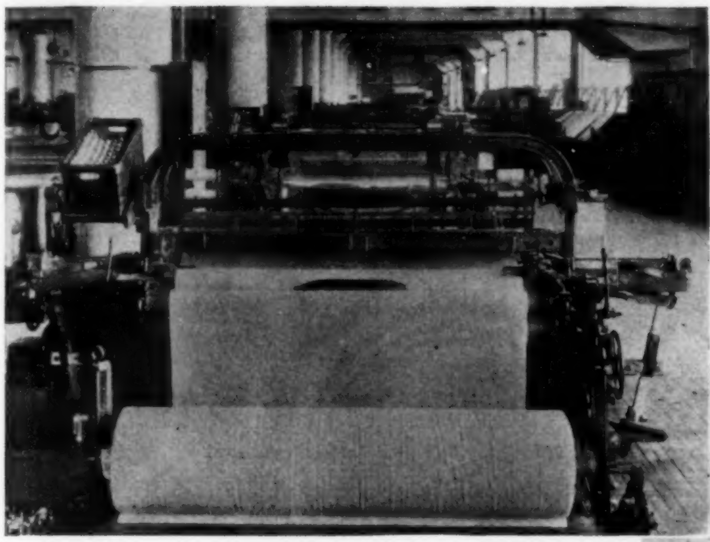
One of the tire making rooms of the Pacific Goodrich Rubber Company plants.

New Tire Factories on the Pacific Coast

New Goodrich plant came into production in 1928 and eight acres of floor space, was built at a cost of $4,000,000 and has a capacity at present of 4,000 tires and 4,000 tubes. The total force numbers 1,800.

The Pacific Coast Goodrich Rubber Company operates many of the latest type Banbury Mixers, with mechanical conveying of the raw material.



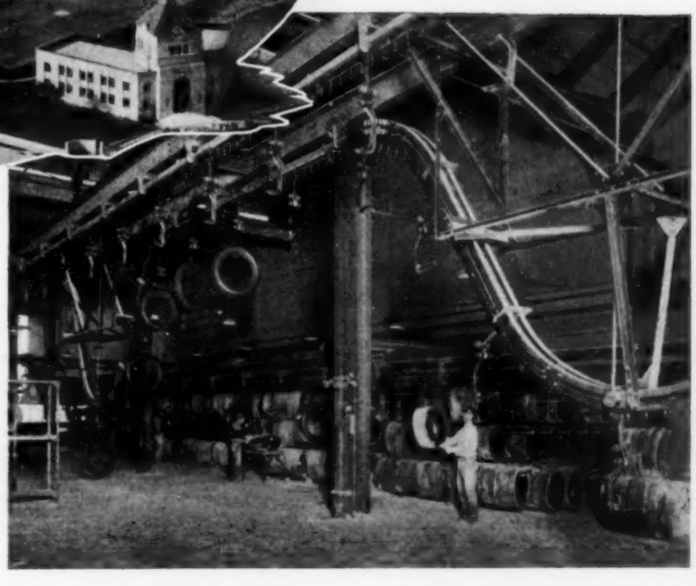


In addition to tires, the Goodyear company fabricates much of its cotton fabric and cord in an adjacent plant from Arizona and California cotton.

The Goodrich, Goodyear and Firestone organizations have recently joined the Samson Tire & Rubber Company with tire and tube factories in California.

A mixing mill in the Goodyear Tire & Rubber Company's plant in California.

Firestone plant was brought into production in 1928. It is located on a 40-acre site and has a floor space of 11 acres. Its capacity is 7,500 tires and 9,000 tubes a day.

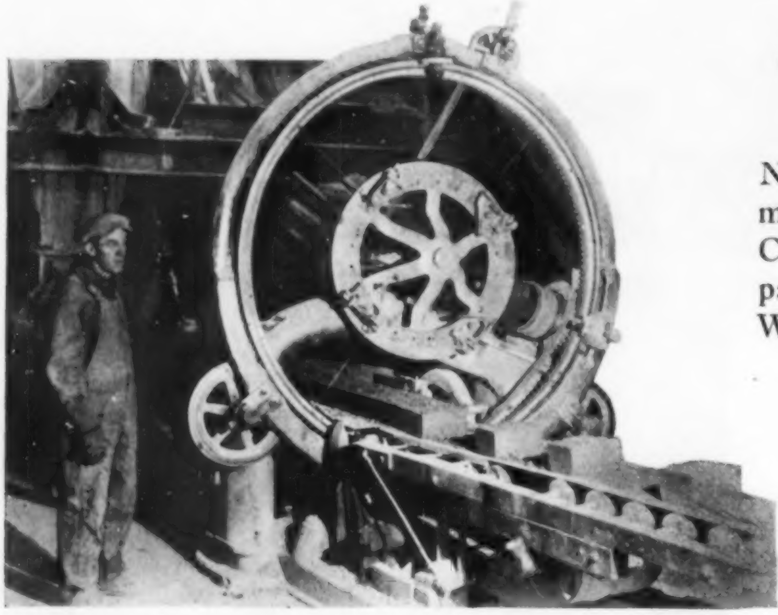


Firestone Tire & Rubber Company of California—an example of modern methods in conveyors

Maker and User of Refractories Gain Through Technical Control

By L. J. Trostel

Chief Chemist, General Refractories Company, Baltimore, Md.



Cutting a Strip of Fireclay Brick in a Pennsylvania Refractories Plant

New laboratory and novel control methods of the General Refractories Company originally described in a paper presented before the Baltimore-Washington Section of the American Ceramic Society.

IN THE MANUFACTURE of refractories, the introduction of technical control has been synonymous with the passing of the empirical and rule-of-thumb methods that long characterized this industry. In the comparatively short time since the establishment of the research laboratories of the Bureau of Standards and of the Refractories Manufacturers' Association at Mellon Institute in Pittsburgh, there have been remarkable advances that have benefited both the maker and the user.

Instead of being limited to fireclay brick, the user of refractories now has the additional choice of magnesite, dolomite, chromite, silica, diaspore, mullite, kaolin, silicon carbide, zircon, and corundum. It is further significant that the actual tonnage of refractories now produced in the United States is not greatly in excess of what it was in 1920—in spite of the rapid growth of the consuming industries and increasingly severe service conditions. The answer, of course, is that the quality of refractories has been so improved that they will withstand the higher temperatures and faster production schedules of modern industry.

Several advances in the processing of refractories have distinctly improved the quality of the product. Originally, refractories were hand-molded, dried, and burned under rule-of-thumb control. Then, as in other branches of the ceramic art, successful production was entirely dependent upon the personal skill and judgment of a few men in the plant. With the introduction of other types of refractories and methods of manufacture, there came a new type of thinking that helped to change the industry from a craft to a scientific basis. The trend continues, for research now in progress has revealed further possibilities of improvement in the drying and burning of silica, magnesite and chrome brick, of casting refractories of definite composition and structure from the fluid melt of an electric furnace, and, finally, of scientifically building up a brick of accurately sized particles in order to furnish a product of maximum destiny and minimum voids. New materials of high refractoriness which have been hitherto unused because they lacked volume stability at high temperature and under load have been successfully modified to meet industrial conditions. Other desirable effects have been attained by carrying out the burning in atmospheres of definite composition. These are some of the gains that technical control has brought to the manufacturer of refractories.

From the viewpoint of the consumer, a product is not suitable for use as a refractory unless it has some of the following qualities: Resistance to melting and disintegration, abrasion, slagging and spalling (thermal, mechanical, and structural), rigidity under load when either cold or hot, and ability to confine heat. These have always been the recognized properties which refractories should possess in whole or in part. Under technical control the industry has been able to induce or improve these properties in the finished brick largely by combining materials of definite characteristics. With the development of suitable tests it has been possible to evaluate these properties and thereby intelligently control them in the processing of the raw material.

HERE it is not possible to review the development of these various tests, except to point out that the trend has been constantly directed toward fundamentals. Such organizations as Committee C-8 on Refractories of A. S. T. M. have taken a leading part in encouraging this movement. The work of Geller and Heindl of the Bureau of Standards, Norton at M. I. T., and Booze and Phelps at Mellon Institute on the spalling test, is typical of this trend. Instead of expressing the spalling resistance only by the number of dips in cold water which a hot brick will stand before its end breaks

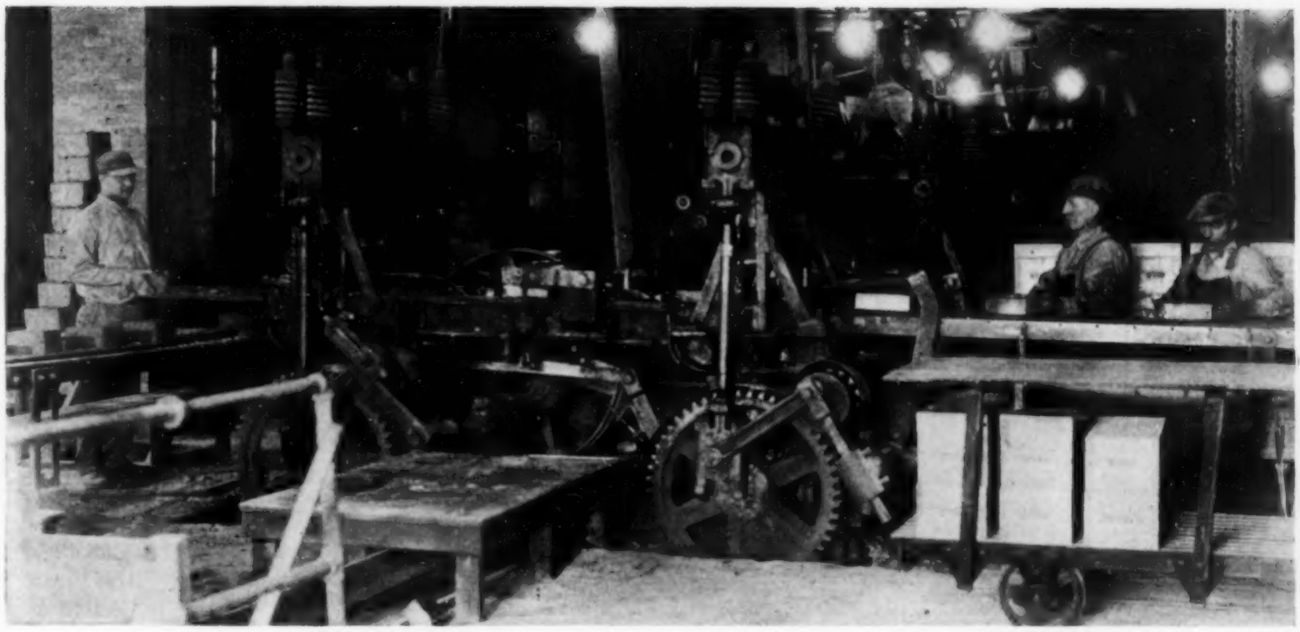


Fig. 1. A Patented Brick Sizing Machine that Insures Refractories of Uniform Shape and Size

This view, taken in the Blue Ball, Pa., plant of the General Refractories Company, illustrates the step in the manufacturing process that follows the wire cutting machine shown in the preceding photograph.

off, we now find actual and accurate measurements of such basic characteristics as the coefficient of expansion, the flexibility in shear, and the thermal diffusivity—the latter being a function of thermal conductivity and specific heat.

At the present time, there are about 175 manufacturers of refractories in this country, and as yet only about ten per cent of them maintain laboratories. Furthermore, fully two-thirds of these laboratories belong to companies that make the "specialties" such as mullite, kaolin, silicon carbide, corundum, and insulating brick as contrasted to the heavy tonnage products such as fireclay, high alumina, silica, magnesite, and chrome brick, which still make up the backbone of the industry.

As a specific example of a progressive firm in the latter group that has recognized the value of technical control, it is of interest to observe the laboratory and test facilities of the General Refractories Company at its Baltimore works. The problems that arise in this company are typical of those of the industry in general, for they have their origin in fifteen different manufacturing plants, five of which manufacture silica brick; eight, fireclay brick; one, magnesite and chrome brick; and one, high alumina brick. In addition, there are accessory clay and coal mines, and ganister quarries which furnish raw materials that must be constantly checked. And, finally, a very imposing array of individual problems, many of these extremely novel, come to the company from the consumers of the finished products.

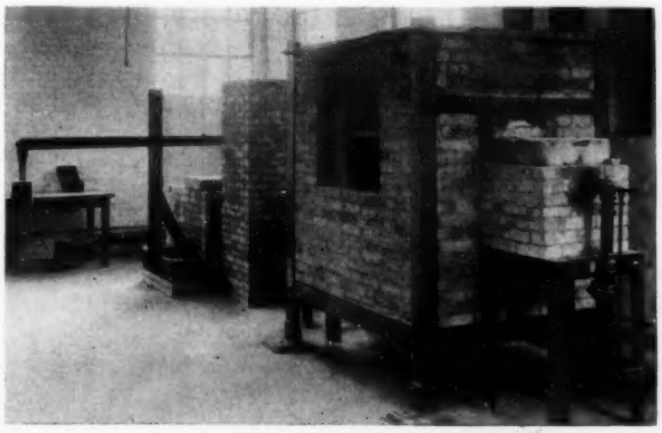


Fig. 2. Physical Testing Furnaces for Determining Spalling and Load Characteristics

The new laboratory building, which is shown in plan below, is a fireproof, two-story brick structure approximately 40x55 ft. in plan, and with an exceptionally deep basement that contains the general and sample stor-

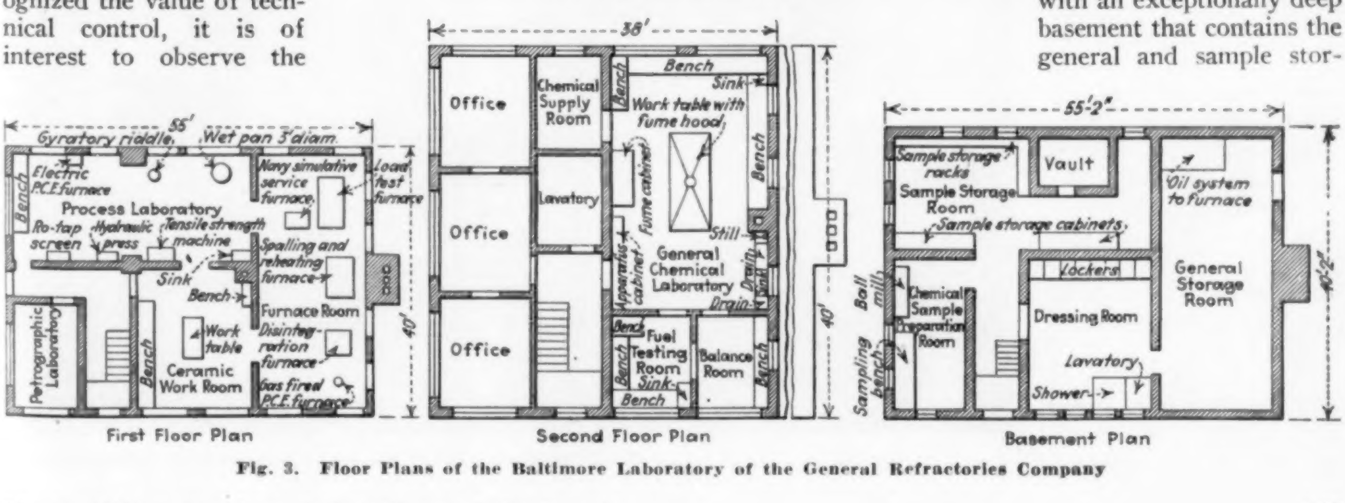


Fig. 3. Floor Plans of the Baltimore Laboratory of the General Refractories Company

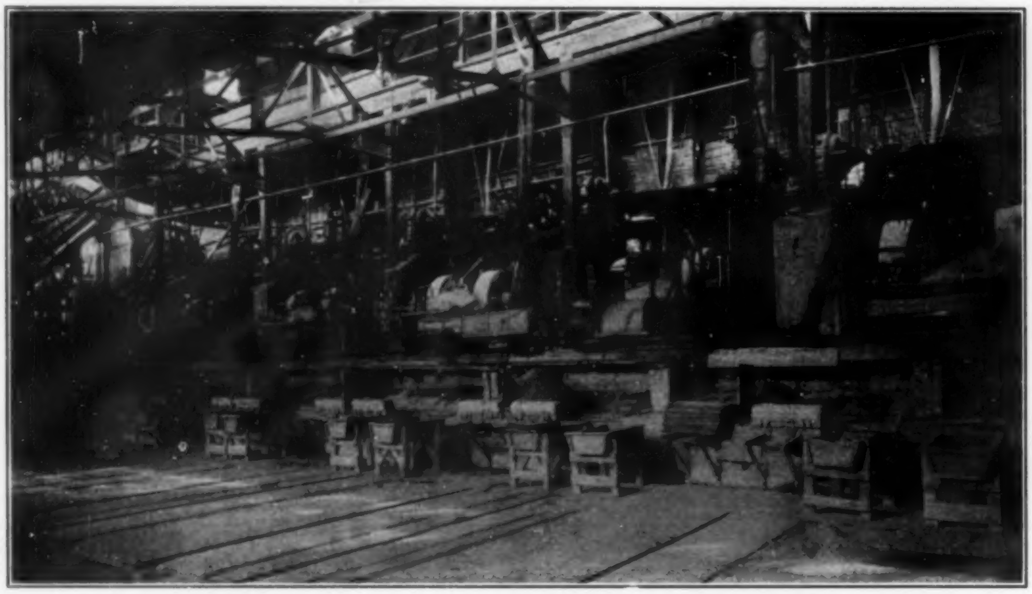


Fig. 4. Grinding and Molding Room in a Silica Brick Plant

age rooms, as well as the chemical sample preparation rooms. The first floor (see Fig. 4) is given over to the process laboratory in which manufacturing operations can be duplicated on a small scale, the furnace room in which the physical testing is done, and a new and completely equipped petrographic laboratory. A feature of this is a molybdenum wound furnace which can be heated up to 1,650 deg. C. for testing small specimens and observing the reactions that take place at kiln temperatures and those reached in metallurgical furnaces. Thin sections of minerals made on a special grinding lathe are examined here under a Leitz microscope.

In the process laboratory, the equipment consists of a small 3-ft. dry pan, a gyratory riddle, a steam-heated drier, and a Watson-Stillman hydraulic press for the small scale manufacture of full-size experimental refractories. The physical testing laboratory includes a standard A. S. T. M. load testing furnace, a spalling and reheating furnace, and two "P. C. E." testing furnaces. (Editor's Note: This term "P. C. E." or pyrometric cone equivalent, is one recently adopted by the A.S.T.M. to supersede such expressions as fusion, softening, melting, and deformation points.) One of these furnaces is heated by oxygen and acetylene gas, and the other (after the design of the Bureau of Standards) is heated by carbon resistance. In addition, there is a special furnace for studying the disintegration of fireclay brick by carbon monoxide, a Navy Department simulative service furnace, and machines for making tensile strength and cold crushing and mechanical screen tests.

The second floor, as Fig. 3 shows, is given over chiefly to the chemical laboratory, which is well equipped with precision balances, electric muffle furnaces, calorimeter, photometer, and similar apparatus. Placing the chemical laboratory on a separate floor from the physical section insures cleanliness, comfort and freedom from dust that would seriously interfere with precise analytical work. Forced ventilation and flood lighting are attractive features of the laboratory. The office, files and the library are also located on this floor.

At the Baltimore laboratory, the staff engaged in active experimentation comprises eleven men, and is divided about equally between the physical and chemical sections. The broad, general objectives of this particular laboratory are conceived to be: First, uniformity of product; second, improved quality of product; and third, lower production costs. To achieve these three objectives, the staff follows five specific lines of activity, viz. (a) prosecution of research problems, (b) routine control of manufacturing operations, (c) servicing of sales and operating departments with technical advice and information, (d) patent investigation and process development, and (e) abstracting of technical literature relating to refractories.

The research projects originate from the customer or user of the brick, from within the production department of the company, or from the members of the staff itself. The routine plant control consists not only of conducting the definite periodical tests required, but also of actually reducing the findings of research to plant practice.

This laboratory has reached a superlative stage in its development among commercial laboratories in the refractories industry. It is believed, however, that it is typical of the general trend toward scientific control.

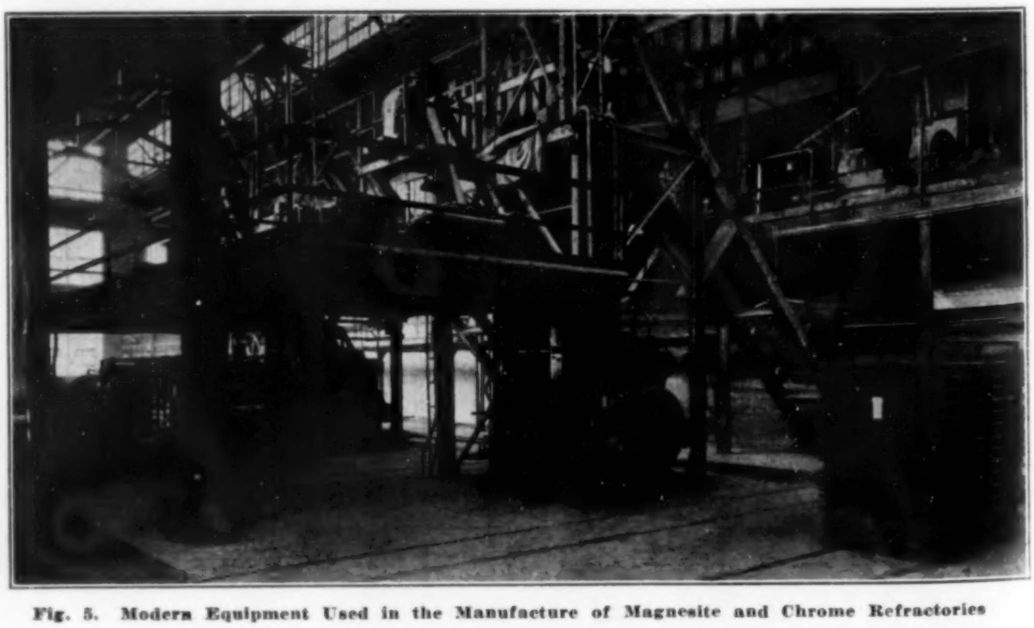


Fig. 5. Modern Equipment Used in the Manufacture of Magnesite and Chrome Refractories

Using Light Sensitive Resins in Decorating Metal

By Murray C. Beebe

Director, Manufacturing Laboratory, Scovill Manufacturing Company, Waterbury, Connecticut

MY INTEREST in the possibilities of finding new light sensitive bodies developed when I sensed the need for new methods of decorating cases at the Wadsworth Watch Case Company, of Dayton, Ky., manufacturers of watch cases. New finishes, which could be used by themselves or in combination with the older methods, such as engraving, engine-turning etc., of decorating such articles, greatly increased the sales possibilities.

On account of the shapes to be decorated, the most desirable method seemed to be to make use of photography and to use a light sensitive coating which would be reacted upon by light of a projected image in such a way that the unreacted portion could be removed readily to allow an etching reagent to act upon the metal. The properties of the coating must be of such a character that they would adhere firmly to the metal to be decorated and would withstand the action of the etching reagents necessary to etch the metals decorated, usually the precious alloys of gold and silver, and brass.

THE IDEA of etching watch cases was old, but it never had been successfully developed on a commercial basis. The light sensitive substances known in the photo-engraving art were chiefly asphaltum and glue or albumen, the latter two sensitized by dichromate.

Some oil varnishes were known to be good etching resists, and it was logical to attempt to sensitize them so that they might be adaptable to the photographic method.

Although series of experiments covering the light sensitive properties of a great variety of oils showed that all the oils possessing an unsaturated chemical character were more or less light sensitive, and the speed with which they react may be very greatly accelerated by means of halogen liberating compounds as sensitizers.

Methods of development involve the use of organic solvents such as naphtha, or turpentine to soften or remove the unreacted portions.

Realizing that light often produces chemical reactions at room temperature, which would be produced by heat without light at elevated temperatures, and that many condensation reactions involved in the production of synthetic resins are greatly accelerated by heat, it seemed reasonable to suppose that synthetic resins might be used as light sensitive media, especially as many of these condensation reactions are exothermic.

The fact that furfural aldehyde was known to change its color when exposed to light confirmed the conviction that we might find in furfural a good lead to follow. With knowledge already gained in the case of the oil base varnishes, that lead iodide and similar halogen liberating compounds were effective sensitizers, it seemed logical, of course, to try these in combination with solutions of partially condensed synthetic resins, to determine if light, in liberating iodine, would not hasten the condensation reaction at the exposed areas to form an image. The rather large field of experimental work which was open was prospected rather effectively by determining which of the known synthetic resins in a state of partial condensation would be further condensed or polymerized without light by the addition of iodine for, of course, such as were found to be sensitive to the addition of free iodine would probably be good photographic media when an iodine liberating compound such as iodoform was incorporated in the medium.

THOSE THAT gave promise by preliminary test were investigated further, though this was not the only criterion of a promising lead. On the whole, the furfural resins seemed to give the most promise, since they printed faster than the other classes of synthetic resins investigated. Some resins are inherently light sensitive, in a fair degree, without any additional sensitizing, but resinous materials, to give printing speeds comparable to albumen, require sensitizers. The synthetic resins are slower in printing than the oil base varnishes already referred to.

Both the oil varnishes and the synthetic resins sensitized as described are chiefly sensitive to the shorter wave lengths of the visible spectrum.

Anti-oxidants, such as hydroquinone, have a marked effect in reducing the speed of printing. The character of the solvent or mixture of solvents used influences the printing and keeping qualities of the solutions.

The synthetic resin coatings are more suitable for contact printing since their printing speed is considerably slower than that of the oil base varnishes. The varnishes are more suitable for decoration of metal or other objects by etching or similar processes.

With suitable dyes incorporated in their solutions, the resinous materials are best adapted to the making of glass positives used in the lithographic trades; to the coating of metal lithographic printing plates to form a tougher image; and for coating copper or zinc plates for photo-engraving. The application to the making of glass positives is especially interesting for the reason that in the making of halftone lithographic color plates, the lithographer is able to make color corrections on the glass positive by reducing the size of the halftone dots in localized areas by local development, in a manner quite similar to that employed by the photo-engraver, who makes his color corrections by local etching of the metal halftone block after it has been "flat" etched. The importance of this property to the lithographer is great, because it gives him a method which the photo-engraver enjoyed exclusively heretofore.

KEEPING qualities of the solution are excellent and coated plates may be kept for considerable periods of time ready for use; also local development may be done in successive steps as its results are proved, until satisfactory.

Synthetic resin coatings have the advantage that the developed portions leave clear glass to transmit the actinic light. This applies to halftone positives as well as to those for line work. Successful grained images have been produced by utilizing the grained surfaces of the lithographic plate to break up a continuous tone picture into suitable tones for reproduction on the press, without the use of a halftone screen.

Both the photo sensitive varnish and synthetic resin are in successful operation in the metal decorating and lithographic trades, and more widespread applications seem likely as the possibilities of using these new light sensitive bodies become known.

What Are the Savings in Handling Muriatic Acid in Bulk?

By C. A. Rauh
B. F. Goodrich Rubber Company
Akron, Ohio

SINCE the development of the Vulcalock rubber-lined tank car five years ago, the question of the most economical method of handling muriatic acid has confronted all large users. Figures showing comparisons in costs between buying acid in tank car lots and carboy lots are available. On the other hand, figures showing freight costs and costs of handling at the consumer's plant are more difficult to assemble and very often neglected or ignored.

It is the purpose of this article to set forth such a comparison of costs, these costs to be based on two methods of handling; one, the old-fashioned method, in carboys; the other, the modern method, in rubber-lined tank cars, rubber-lined steel storage and pressure tanks equipped with rubber-lined steel pipe, rubber-lined cast iron fittings and rubber-lined, relinable cast iron valves.

The following items of cost are to be dealt with:

(1) Cost per cwt. (100 lb.) of the acid f.o.b. acid plant.
(2) Freight weight of the acid and container.
(3) Freight rate on the acid and container.
(4) Freight weight of returned container.
(5) Freight rate on returned container.
(6) Investment in equipment.
(7) Interest, depreciation and repairs (breakage).
(8) Direct labor involved.
(9) Storage space required.

Shipment by Carboy

(1) Cost per cwt. of the acid f.o.b. acid plant.

These prices change from time to time but the ratio remains approximately the same. In carload lots (150 carboys min. to 200 carboys max.) the price per cwt. is usually \$1.35 to \$1.45. In less-than-carload lots of 25 carboys or more the price is \$1.85 per cwt. In lots of less than 25 carboys the price is \$2.05 per cwt.

(2) Freight weight of the acid and container.

The carboy and box weight 75 lb. min. The acid weighs 125 lb. approximately. Total 200 lb. min. If the packing in the box is wet, the weight may run as high as 125 lb. for the empty package. However, we shall neglect in this paper the extra package weight due to wet hay or straw or other types of packing.

(3) Freight rate on the acid and container (carboy).

To illustrate the difference we take an example of shipment to two points—*A* to *B*, and *A* to *C*. These figures are actual rates.

	A to B	A to C
Carload lots—Class 5............	\$0.14 per cwt.	\$0.17 per cwt.
Less carload lots—Class 1........	0.405 per cwt.	0.49 per cwt.

(4) Freight weight of returned container.

Carboy and box 75 lb. min.

(5) Freight rate on returned container.

	A to B	A to C
Carload lots—Class 5............	\$0.14 per cwt.	\$0.17 per cwt.
Less carload lots—Class 3........	0.27 per cwt.	0.33 per cwt.

(6) Investment in equipment.

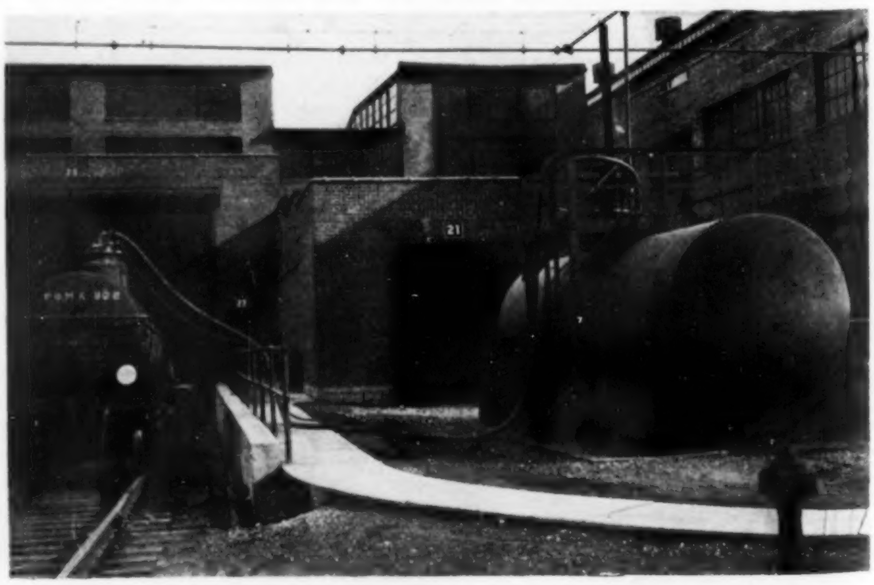
A deposit of \$5 each for carboys, which deposit is refunded when carboys are returned in good condition. Handling equipment, such as trucks and hoists at consumer's plant. This figure will vary considerably with each plant.

(7) Interest, depreciation and repairs (breakage).

Breakage of carboys by consumers will average about 1 per cent per month. This often means loss of acid as well as destruction of carboys. Damage to buildings, destruction of floors and accidents to workmen would also be considered under this item. This figure, while indeterminate, is very important.

(8) Direct labor involved.

This depends on the number of carboys handled. Generally, two men can unload a car of carboys in one day. In addition, at least one man's time is devoted entirely



The New Method—Tank Car and Storage Tank

to transporting from storage shed to process tanks. At least one precess man additional is necessary.

(9) Storage space required.

This depends on the number of carboys required. If carboys are kept out in the weather, water and snow get into the boxes, increase the weight and often cause breakage due to freezing in the winter months.

Shipment by Tank Cars

This method requires the use of rubber-lined storage and pressure equipment by the acid user.

(1) Cost per cwt. of the acid f.o.b. acid plant in tank car lots.

This price may vary from time to time, but is approximately correct, to state that for lots of 5,000 to 10,000 gallons, the price will be $0.95 per cwt.

(2) Freight weight of the acid container.

Consumer pays freight on contents of car only. No dead weight freight charges are assessed.

(3) Freight rate on the acid and container.

Tank car shipments take Class 6 rating which will amount in the following actual cases to:

A to B	A to C
$0.115 per cwt.	$0.14 per cwt.

(4) and (5) Freight weight and freight rate on returned container.

There are no charges for return freight on tank cars.

(6) Investment in equipment.

Equipment would consist of storage and pressure tank and pipe lines to process tanks. This cost would depend on size of storage tank and length of pipe line. It would probably be between $2,500 and $7,000.

(7) Interest, depreciation and repairs (breakage).

The interest on the investment of $2,500 to $7,000 at 6 per cent figuring on retirement in 20 years. There are many instances on record where storage tanks lined with uncured rubber have lasted 20 to 30 years. A cured rubber lining should last as long or longer. Rubber does not age materially inside a storage and pressure tank where no sunlight is present. Breakage is unheard of in rubber-lined steel storage tanks. Damage to buildings from fumes and to floors, etc., from spillage is entirely eliminated by the use of the storage and pressure tank.

(8) Direct labor involved.

Direct labor is cut down to a minimum. In a few hours two men can empty a 10,000 gallon tank car. The pipe lines are run directly to the process tanks. By this method acid can be handled as safely and as conveniently as water.

(9) Storage space required.

The space required is less than for storing and handling carboys. The storage tank can be placed above or below ground without affecting its operation. Aisles, elevators, etc., necessary for carting carboys can be dispensed with or used for better purposes. In addition to these advantages the general appearance of the buildings and property is improved by doing away with carboys.

The table which appears herewith gives in concrete form the results of the savings which have been indicated above. The estimates are based upon actual acid prices and actual freight rates.

The larger the storage and pressure tank, the lower is the investment cost per gallon of capacity. A 5,000 gallon tank will cost about 42c. per gallon while a 10,000 gallon tank will cost about 33c. per gallon capacity.

In addition to actual saving effected by the adoption of the storage and pressure tank system, the general appearance of the plant and surrounding property is improved, the morale of the workmen is raised and another step is taken toward general safety and the prevention of accidents to both employees and equipment.

How Much Could You Save by Using Rubber-Lined Steel Equipment?

This manufacturer, whose plant is at *A* buys 200 carboys a month from an acid plant at *C*.

The Item	*The Method*			
	In Carboys		In Rubber-Lined Steel Equipment	
(1) Acid cost f.o.b. acid plant	25,000 lb. at $1.35 per cwt.	$337.50	25,000 lb. at $0.95 per cwt.	$237.50
(2) Freight weight of acid and containers	40,000 lb.	....	25,000 lb.	....
(3) Freight rate of acid and containers	$0.17 per cwt. (5th class)	68.00	$0.14 per cwt. (6th class)	35.00
(4) Freight weight of returned containers	15,000 lb. min.	....	None	....
(5) Freight rate of returned containers	$0.17 per cwt. (5th class)	25.50	None	....
(6) Investment in equipment	200 carboys at $5 each $1,000	....	5,000 gal. tank and pipe line, $3,000 max.	....
(7) Interest on investment, repairs and breakage	$5 per month, $15 per month	20.00	$20. No repairs or breakage	20.00
(8) Direct labor	2 men 1 day and 1 man 20 days per month	108.00	2 men ½ day per month	5.00
Comparative approximate monthly cost		$559.00		$297.50

The Traditional Method—Carboys in Conspicuous Abundance

Corrosion Symposium Features A.I.M.M.E. Meeting

Editorial Staff Report

CORROSION Symposium was an outstanding feature of the meeting of the American Institute of Mining and Metallurgical Engineers held in New York City, February 18-22, 1929. The widespread interest in this subject was evidenced by the large attendance at the meeting which was presided over by H. A. Bedworth of the American Brass Company. Dr. Ulick R. Evans, of Cambridge University, the annual lecturer of the Institute, acted as honorary chairman.

One of the outstanding papers was that by Henry S. Rawdon, metallurgist of the Bureau of Standards, on the correlation of laboratory corrosion tests with service: weather-exposure tests of sheet duralumin. To date outdoor exposure tests on sheet duralumin have been conducted, for three years, in various localities. These show a close parallelism with the accelerated corrosion tests previously carried out in the laboratory by the wet and dry method in a sodium chloride solution. These tests proved that the lack of permanence or embrittlement of sheet duralumin which has been observed in some of this material in service under similar conditions is largely, if not entirely, to be ascribed to corrosion. The tests, both in the laboratory and in the field, were carried out upon full-sized tension bars, the change in the tensile properties being used as a measure of the effect of corrosion. Variations in the heat-treatment procedure used for duralumin appear to be major factors in determining the susceptibility of the heat-treated sheet to intercrystalline corrosive attack during exposure to weather and likewise in accelerated corrosion tests.

AGAIN D. J. McAdam, Jr., presented interesting data with a review of his previous experiments on corrosion fatigue, showing clearly that stress, time and the number of cycles each have a distinct effect in lowering the endurance limit. The author uses resistant fatigue limit as a criterion of the depth and sharpness of corrosion pitting. Four variables in their entire relationship were considered. McAdam first discussed the relation between corrosion-stress and resultant fatigue limit with the other two variables held constant. The form of the graph, which the author showed, representing this relationship, indicated local strengthening of the metal at the bottom of the corrosion pits. The field of investigation was then extended to include stress between zero and the endurance limit. By thus widening the range of corrosion-stress it was then possible to extend the range of cycle frequency so as to include frequencies as low as 5 cycles per hour. This paper included in addition the effect of steady and intermittent tensile stress on corrosion, the stress-time cycle relationship as affected by varying corrosion conditions, and the stress-time cycle relation as it affects the corrosion of corrosion-resistant steels and non-ferrous metals.

Resistance of copper-silicon-manganese alloys to corrosion by hydrochloric and sulphuric acids, was discussed in a paper presented by Chairman Bedworth. He showed that additions of silicon and manganese up to 3 and 1 per cent, respectively, increased the resistance of copper to corrosion by these acids, and that larger additions, within working limits, were of little benefit.

Hard-drawn wires containing more than 2 per cent silicon showed decidedly greater loss by corrosion than annealed wires of the same composition. The loss of annealed wire approached that of hard wire as the silicon content decreased from 2.5 to 0.5 per cent.

Corrosion of tin and its alloys was discussed by C. L. Mantell, consulting engineer, Pratt Institute. The paper was a compendium of useful knowledge concerning tin and dwelt on the chemical properties, physical corrosion, chemical corrosion of tin plate and tin alloys.

Other papers that were presented at the symposium included: "Quantitative Measurement of Corrosion of Metals in Water and Salt Solutions" by G. D. Bengough, J. M. Stuart and A. R. Lee of Teddington, Middlesex, England. Dr. Evans presented this paper for the authors and characterized it as one of the best on the subject which had ever been produced in England. This paper demonstrated that the corrosion of various grades of zinc was electrochemical in nature, and was a function of the chlorine ion. Burnham E. Field of the Union Carbide & Carbon Research Laboratories, Inc., presented a paper on some new developments in acid-resistant alloys in which the developments of nickel-molybdenum-iron and nickel-silicon-copper-aluminum alloys resistant to hydro-chloric acids and other corrosive liquids, were described. The practical application of corrosion tests: resistance of nickel and Monel metal to corrosion of milk was presented in a paper by Robert J. McKay, O. B. J. Fraser and H. E. Searle of the Development and Research Department of the International Nickel Company. H. V. Churchill presented a note on the inhibition of the corrosion of aluminum by soaps, which brought out the fact that corrosion of collapsible aluminum tubes by soap can be prevented by the addition of a small amount of silicate of soda as an inhibitor. The corrosion of metals in the Lehigh Valley was discussed by C. E. Reinhard, of the Research Division, of the New Jersey Zinc Company. This paper contained preliminary data as evidence of the necessity for the identification and evaluation of the variables of corrosion and as an illustration of the variations to be considered in the development of a useful accelerated test. T. S. Fuller, of the Research Laboratory, of the General Electric Company, presented a paper on some aspects of corrosion fatigue.

FOLLOWING the symposium, Evans delivered the Lecture, "Passivity of Iron and its Relation to Corrosion Problems." He ascribed the passivity of iron to invisible oxide film which is the direct product of oxidation at ordinary temperatures, likewise to a directly formed film of iron phosphate produced by anodic action of iron in a sodium phosphate solution. He further said that clearly the conversion of the surface layers of the metal into oxide, or phosphate must tend to protect the metal below.

By ingenious and original methods, Evans has been able to outwardly isolate these oxide and phosphate films and study them under the microscope. After the lecture he exhibited a large number of interesting specimens, including isolated oxide films.

Acknowledgment is made that the article in the February issue, "Providing for Patent Obsolescence in Chemical Industry," by F. P. Byerly, was from a paper presented at the meeting of the American Association for the Advancement of Science, New York City, Dec. 27, 1928, to Jan. 2, 1929.

Petroleum Technology Advances To Meet Economic Needs

By H. W. Camp

General Superintendent, Empire Oil & Refining Company Tulsa, Okla.

EDITOR'S NOTE — *To avoid duplication with technological activities of the American Petroleum Institute, the petroleum division of the American Institute of Mining and Metallurgical Engineers limited the program of its recent New York meeting to geology, field engineering and economics. But a single paper, extracts of which are presented here, dealt with the advances in refinery technology. It is an able review of notable chemical engineering accomplishments in 1928.*

ECONOMIC pressure has given impetus to progress in the development of primary distillation equipment, including stills, towers and heat saving devices. A pipe still and bubble-cap fractionating equipment can now replace a battery of shell stills, giving better yields, better control, elimination of rerunning and lowering of operating costs. The most recent pipe stills are being equipped with either radiant heat furnaces or air preheating systems and improved heat exchange equipment. These can be operated on a fuel consumption as low as one per cent of the charge as compared to a fuel consumption of 3½ per cent of charge on shell still batteries. Fractionation is now so controlled that almost any separation desired can be effected in one operation. Streams can be separated so that only a portion of the products will require treating or can be divided so as to retain anti-knock properties and at the same time, eliminate gum-forming substances.

It is sometimes uneconomical to write off a big investment in shell stills. Instead of abandoning these, it has been found profitable to equip them with air preheaters, improved furnaces, bubble-cap towers and heat exchangers so that their efficiency may be comparable to pipe-still installations. A recent development in shell still design is the addition of interior tubes with suitable headers. This has improved efficiency and presents a further possibility of utilizing old shell-still batteries profitably.

There is a tendency toward the installation of continuous treating systems in preference to batch agitators. The adoption of recirculation in agitators has made a big improvement in batch treating. Regeneration of caustic soda is employed, and the material is re-used until causticity is as low as 2 per cent. Acid recovery systems are used which recover as high as 80 per cent of the acid, and even the litharge for sweetening gasoline can be re-used many times.

Losses have been decreased through the installation of vapor recovery systems, vapor-tight and floating roofs, acid sludge and emulsion recovery systems, and improved methods of loading and unloading volatile oils. Vapor-recovery systems gather gases from stills, tanks, agitators and loading racks, then through an absorption process, recover about 85 per cent of the gasoline, the residue being burned for fuel.

Cracking Advances—The largest single factor for the advancement of refinery practice is the pressure still. Add sufficient cracking capacity to a skimming plant in order to convert the heavier fractions into gasoline, and the yield increases from 32 to 66 per cent. The realization from a barrel of crude, considering higher manufacturing expense, increases from \$1.74 to \$2.44 per bbl. and the gallonage of gasoline from a barrel of crude is doubled.

While there have been no radical changes in liquid phase cracking equipment during the past year or so, there have been many improvements. The present trend is toward larger capacity units, higher fuel efficiency, finishing gasoline direct from units and controlled operation so as to produce gasoline with better anti-knock properties. Higher operating pressures, reduction of coke and fixed gases, retardation of corrosion and other problems are being worked out so that we may expect to see improvements. Methods are being developed to recover valuable byproducts including alcohols, esters and various types of synthetic products.

Much progress has been made during the past year in the development of the vapor phase pressure still. Several workable processes have been developed and a number of commercial installations have been made. Gasolines having high anti-knock properties are produced by this method. It is a fact that the vapor phase pressure stills produce a larger quantity of fixed gas. This gas has a large unsaturated hydrocarbon content which may be recovered and probably converted into valuable products through synthetic chemistry.

Corrosion—The recent production of crudes having high sulphur content has presented a new problem to the refiner by corrosion of his equipment; indeed, distilling equipment has been literally eaten up in a few months when distilling this crude. The refiner is attempting to combat this condition to the best of his ability by various methods such as pretreatment of crude with alkalis, injection of ammonia and caustic into vapor lines, condensers, exchangers, towers and stills. Liquid caustic is added in rundown lines to eliminate corrosion in lines and tanks. Various types of leadclad roofs and coatings of protective paint are used in tanks. There is the possibility of the use of aluminum tanks for resisting corrosion as they are not affected by the sulphur compounds.

Lubricating Oils—Several new features have come into practice in regard to the processing of lubricating oils in recent times. Vacuum distillation in all its aspects is probably foremost among these. For some time vacuum distillation has been successfully applied to batch shell stills in the production of asphalt base crude oils. The latest development has been to adapt the pipe still to vacuum still practice using suitable fractionating equipment designed to make as many cuts as desired. Overheating of oils causing breaking down is avoided in this type of installation and maximum yields of lubricating oils are secured. A new development in vacuum still practice is the use of an indirect heating medium such as mercury vapor or diphenyl.

The refiner cannot claim all of the credit for the development of improved equipment because the manufacturers themselves have contributed largely to this constructive progress. Co-operation and distribution of information between the refiners and equipment manufacturers has led to a better understanding of the problems involved and permitted of a much more widely spread utilization of up-to-date processing. Space will not permit the naming of dozens of improvements which are small and highly technical but which, nevertheless, have a vital part in plant operation. The development of the art of welding has played a very prominent part in the advancement of refinery technique since many pieces of equipment are in use which would be almost impossible to construct and maintain if the old pipe-fitting methods were resorted to.

Publishing Chemical Statistics Would Aid Industry

By Theodore M. Switz
Investment Research Corporation, Detroit, Mich.

STATISTICS, to many people, are merely endless columns of dull and meaningless figures; others have found that when used intelligently they are as useful and as indispensable as tables of logarithms, as volumes of Beilstein or the International Critical Tables. One industry after another has gradually realized that economic research is at once as necessary and as profitable to the conduct of modern large-scale corporations as is scientific research. The Telephone Company, for example, was one of the first to build up a strong statistical organization which it uses in calculating the growth of districts and cities, in planning for the installation of new equipment and the amount of new capital that will be required from time to time, and in general in supervising the company's extensive activities in purchasing, manufacturing and construction. Predicting the price of copper is one of its most important duties. Public utility companies, such as the Detroit Edison, also make careful studies of general business conditions and the prices of commodities in order to plan their construction work.

Some concerns have found that by making a sufficiently thorough study of the industry in which they are engaged, the consumption of a given commodity can be predicted with considerable accuracy some months in advance, thus giving them an opportunity to stabilize production.

IN THE CHEMICAL industry, the progressive research directors believe an economic survey should precede any comprehensive research program, that it should be revised and extended as the work progresses. Indeed, many an idea that looks good on paper would be of absolutely no economic value even if the scientific and technical problems could be overcome. It is the object of commercial research studies to detect fallacies of this kind in advance, and in general to aid in directing the scientific activities into the most useful and profitable field.

Since statistics are the foundation stone on which such studies are based, let us see what series are available today to the commercial research worker who is investigating some phase of the chemical industry. The list is not long, for aside from the estimates of the trade journals and the usual import and export figures, all the primary sources may be summarized in a single sentence: the Census of Manufactures which is taken once every two years, the Census of Dyes and Other Synthetic Organic Chemicals which appears annually, and the *Survey of Current Business*, a monthly publication of the U. S. Department of Commerce. Each of these sources of information is admirable, and it is hardly possible to praise them too much, especially when one considers the almost total lack of such statistics in England, Germany or France. But the final criterion of their value is not whether they are better than those of other countries, but whether or not they are adequate to solve the continually recurring economic problems that confront the American chemical industry. From this point of view, as might be expected, there are many gaps. It is impossible to charge the government departments responsible for these publications with lack of thoroughness, for the real explanation seems to be partly lack of interest by the chemical industry itself, and partly an exaggerated secretiveness. Now that interest in commercial and economic research work is becoming so general and secretiveness is on the wane, it seems worthwhile to point out omissions and make some general suggestions for improving chemical statistics.

ON THE WHOLE little criticism can be levelled at the annual and biennial figures. They are comprehensive. Current monthly statistics, on the other hand, are far too few and unrepresentative. Yet monthly series are of the greatest value—indeed they are so useful that in most cases they amply justify the extra trouble that is necessary in their preparation and collection. Their chief merit is timeliness. Because of the thoroughness of annual and biennial figures more time is required in collecting them, and then there is an inevitable time lag in publication, so that when they finally appear they are from one to two years out of date. Monthly statistics are thus of great assistance in following the situation during intermediate periods between the regular censuses. Probably the greatest advantage of monthly figures, however, lies in the opportunity they afford of studying seasonal variations, and investigating the interrelations between prices, production, and stocks of various commodities. Yearly figures are practically useless for this purpose. Chart 1 which shows the monthly shipments (withdrawals) of denatured alcohol, illustrates this point very clearly.

The tremendous seasonal variation (due largely to the winter demand for anti-freeze) is evident at once. While this phenomenon is well-known to men in the industry, an outsider would be unaware of it if only annual figures were available. Moreover, monthly figures permit the calculation of a 12 months' moving-average, shown by the dotted line in the chart, which removes the seasonal swings and shows the actual trend.

Having considered the advantages of monthly statis-

tics, let us now examine the series that are at present available for chemical products. The entire list is shown in Table 1.

Table 1—Monthly Series of Chemical Statistics
(from the *Survey of Current Business*)

Product	Figures Available		
Acetate of lime[1]	Production,	shipments,	stocks
Methanol (crude)[1]	"	"	"
Methanol (refined)[1]	"	"	"
Ethyl alcohol[2]	"	"	"
Explosives[3]	"	"	"
Acid phosphate[4]	"	"	"
Sulphur[5]	Quarterly	production	only

Sources:
[1]National Wood Chemical Assn.
[2]U. S. Bureau of Internal Revenue.
[3]U. S. Bureau of Mines.
[4]National Fertilizer Assn.
[5]Texas State Comptroller.

This list is so small and unrepresentative as to be almost ludicrous. Of course, some other figures are published which are not shown in the above table, such as the almost negligible exports of sulphuric acid, but in relation to manufacturing conditions in this country they are of relatively little value. How does this list of current statistics compare with the figures published for and by other great American industries? Is the chemical industry so secretive and so highly competitive that it is utopian to hope for anything better? This hardly seems to be the case. Other industries, such as steel, automobiles and electrical equipment are fully as competitive as the chemical industry, if not more so.

In Table 2 are listed various important chemicals and chemical products which are produced in large volume. Monthly statistics of the physical volume of production for most of them could be obtained with relatively little trouble. Dollar volume of production would be of much less value because of changes in the price level.

Table 2—Suggested Monthly Production Statistics of Chemicals

Heavy chemicals	
sulphur (shipments, not production)	ammonium sulphate
soda ash	caustic soda
chlorine	calcium carbide
Coal-tar intermediates	
benzene	salicylic acid
toluene	aniline
naphthalene	phenol (natural and synthetic)
nitrobenzene	B-naphthol
phthalic anhydride	
Miscellaneous	
ethyl acetate	nitrocellulose
butyl acetate	soap
acetic acid	rayon

This list is not meant to be exhaustive in any way, but only to be suggestive of certain bulk chemicals on which statistics could reasonably be collected, and which would be generally useful. It is important to point out here that complete production statistics are not at all necessary. If a trade association representing say 60 or 75 per cent of the production of an industry will agree to publish the combined production of its members each month, and the ratio this bears to the total is known, such a figure is practically as valuable as the total itself, while being infinitely easier to obtain.

As was mentioned above, the Census of Dyes is a very fertile source for statistics dealing with organic chemicals of all kinds. In using it, however, one often feels that there are more blank spaces in it where the Tariff Commission withholds the data, in order not to disclose the production of an individual firm than there are spaces where the statistics are published! This is really a very serious situation, for many of these commodities are of considerable importance, such as butanol, ethylene glycol, furfural, etc., yet in accordance with

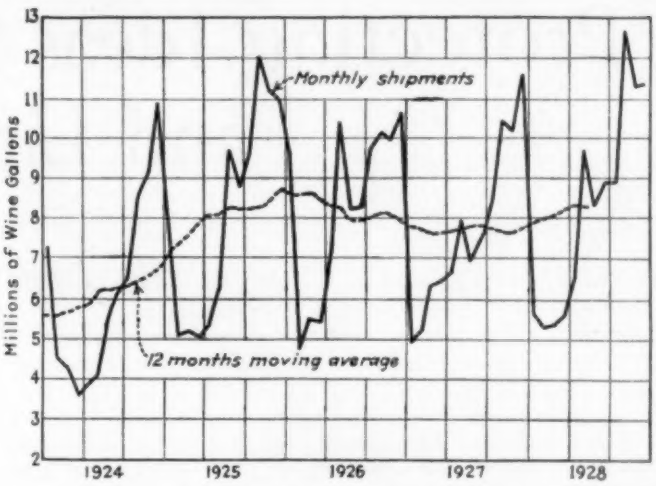


Chart 1—Monthly Shipments of Denatured Alcohol

the centralization of the chemical industry, it is inevitable that they be produced by only one or two firms. How, then, is the problem to be met? No one can object to the desire of any firm to keep its current production figures secret, but is there any objection to publishing past production—say one or two years back? These old production figures would be so antiquated as to be useless to competitors, yet they would be of general economic interest, and would round out our knowledge of the industry.

One final suggestion that would be of great assistance to all those who are concerned with the economic and financial aspects of the chemical industry intrudes rather closely into the private affairs of certain companies. Yet it seems sufficiently important to be worth making. The scope of the activities of the three major chemical companies—Allied Chemical and Dye, du Pont, and Union Carbide is so broad that taken together they make a very good cross-section of the industry. Consequently if they would agree to publish individually their total sales in dollars each month, such a series of figures would soon be of the greatest value in making economic and financial studies of the industry as a whole. If they should be unwilling to publish their figures individually, a composite figure published by the Department of Commerce representing the combined dollar sales of all three would also be extremely useful. Does this suggestion sound extremely startling or unreasonable? One must remember that among others, firms of the size and standing of Woolworth, Montgomery Ward, Sears Roebuck, Kresge, Childs, United Cigar, Schulte and U. S. Steel (reports monthly earnings) publish their monthly dollar sales in the *Survey of Current Business.* And no one can explain this open policy by claiming that these concerns are in non-competitive fields, nor accuse them of any lack of success as a result of it!

The steadily growing amount of commercial and economic research work that is now going on in the chemical industry, makes the question of adequate statistics of ever greater importance. Publication of the various statistical series mentioned above, including monthly production statistics, annual production figures one or two years back in the case of products made by only one or two firms, and individual or combined monthly sales for the three major chemical companies, would go a long way toward making chemical statistics as complete and useful as those of any other important industry in the country.

Protecting Ideas Through Patents and Litigation

By Louis Burgess

Patent Attorney, New York

EDITOR'S NOTE: *The author, whose former connection with the Standard Oil Company of New Jersey, gave him an unusual combination of engineering and legal experience, contributed an article to the February issue of Chem. & Met. entitled "What Constitutes Invention?" In his concluding article he outlines the proper procedure for the engineer in patenting an invention and defending it against infringement.*

EVERY engineer should have a clear understanding of the capabilities and limitations of patents, viz., what they will do and particularly what they will not do. The grasp of this understanding will be facilitated by a realization of their fundamental character: A patent is a contract between the inventor and the government in which the inventor communicates his idea to Society, with instructions which must enable Society to practice it, in exchange for which the government yields him the right to exclude others from the use thereof for a defined period. This includes the right to restrain all others from creating the thing or duplicating the method which he has invented. It does not include any corresponding right for the inventor to practice it himself unless the idea is simultaneously out of the scope of all valid outstanding patents owned by others.

It follows that a patent is not a guarantee of the right to practice the idea described therein and it frequently happens that two or more inventors control different phases of a proposition in such a way that no one of them can practice his invention without the consent of the others. A situation of this character occurs where one inventor has patented a method broadly and a second has obtained a patent covering an improvement which is essential to its commercial application. The patentee controlling a general situation must therefore endeavor to anticipate others in discovering and protecting those improvements on which successful commercial application depends.

The property created by a patent is limited to the particular idea disclosed and claimed. If others can obtain the same result by different means the patentee can exact no tribute. It is therefore imperative in drafting an application for a patent to present the invention in the broadest and most inclusive way possible so long as it is not imperilled by confusion with the prior art.

Even though the property created by a patent is only the right to exclude others from practice it is substantial and far reaching. The patentee may invoke summary remedies such as injunction and triple damages to protect this property. He may administer it as an absolute monopoly and stand upon any terms however exorbitant; he may even elect to suppress its employment altogether. This property attaches even to those who may have set up machinery for the practice of the idea before the patent issued, on some false assumption; they may only acquire the right to continue to use this machinery by arrangement with the patentee.

The protection of this property is left to the courts. In this regard patents stand on the same footing as all other property. The owner must be vigilant and aggressive. There are some who advocate that the government exercise a paternal supervision over its patents, as for example by voluntarily seeking out and punishing infringers, but any effort on the part of the government to interpret and enforce of its own volition the thousands of unexpired patents would constitute a political meddling that would undermine business stability. The present system is the only practical one.

Classes of Patentable Inventions. Patents may only be obtained for the specific classes of inventions enumerated in the statute. The field of patents is therefore precisely limited in contrast to the field of inventions which is not so limited.

The classes of inventions for which patents may be obtained are enumerated in Sec. 4886 of the U. S. Revised Statutes as follows:

> Any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, . . . may . . . obtain a patent therefor.

There is an additional class known as design patents which is not primarily of engineering interest and therefore will not be considered in this article.

COMPOSITION of matter may be defined as something of value because of intrinsic properties independent of its form. It may be a simple compound, in the chemical sense or a mixture. Gunpowder is an example of the class. An article of manufacture is something which is of value because of its properties and its form, for example a tank or the arch of a bridge. A machine is something which is capable by the relative motion of its parts of performing a definite function when power is impressed upon it. As employed in the statutory section above quoted the term "art" includes any sequence of physical steps impressed upon materials to effect a definite result. The terms "method" and "process" are interchangeably used as synonymous with "art" by the courts and the Patent Office, although in more accurate use the term "process" comprehends a sequence involving chemical change and "method" a sequence involving only physical change.

The classes just referred to were probably intended to include every invention susceptible of physical embodiment or application. In any event the courts appear to have proceeded on this assumption and to have re-

interpreted the statute until the classes mentioned have been made to include everything of this character. The early decisions, for example, held that a building structure, although embodying invention, was not patentable because it was not an article of manufacture but later decisions have reversed this holding and have ruled that

> An article of manufacture embraces whatever is made by the art of industry of man, not being a machine, a composition of matter, or a design.

It was similarly disputed for a time whether the first to produce a definite chemical compound could obtain a patent therefor as a composition of matter, but this point also has apparently been decided in the affirmative. The statutory classes of patentable inventions now appear therefore to cover every invention susceptible of physical translation.

An example of an invention not susceptible to patent protection is a novel system of doing business. Such inventions have been denied protection because incapable of effecting a physical result. Newton's creation of the differential calculus, although an invention of the first order of merit, would not be patentable.

PROCEEDINGS and routine incidental to obtaining a patent are initiated by filing an application with the Commissioner of Patents. The subsequent procedure consists of exchanges between the Patent Office and the inventor's representative in which reasons that militate against the issue of the patent are customarily advanced by the Office while the inventor amplifies his explanations and revises his claims until a basis is reached upon which the office either passes the case to issue or flatly rejects it as lacking invention. These negotiations are principally conducted by the primary examiners each of whom has a supporting staff of about eight assistants. Appeals from the primary examiners are taken to a Board of Appeals, which consists of three Examiners-in-Chief drawn from a panel consisting of the six Examiners-in-Chief and the Assistant Commissioners. There are of course special proceedings and examiners with special capacities, a description of which would merely burden this article. The executive administration of the Patent Office is discharged by the Commissioner supported by the First Assistant and Assistant Commissioners.

The executive heads of the Patent Office are men of outstanding ability and high ideals. It is due principally to their devotion that the Office functions as smoothly as it does. The difficulties against which they are forced to contend are largely attributable to public apathy and political indifference.

The situation was well summarized in a statement by Commissioner of Patents Robertson, which appeared in the *U. S. Daily* on Nov. 26, 1928:

> The work of the Patent Office is seriously hampered because of the insufficient number of technical examiners available. Although the applications for patents have increased more than 11,000 since 1925, the force of examiners is actually less now than it was during that year. The delay in acting on the applications has a tendency to act as a drag on the industries of this country. Because of the insufficient personnel to handle the business, cases awaiting official action have risen to 106,575—the largest number ever recorded, and an increase of approximately 42,000 over last year.

Some divisions of the Patent Office are only a few months behind but the average delay in acting on pending applications is probably about nine months. Most applications involve two or three office actions, some require several and the consequence of this delay is to retard the issue of a patent for from one and one-half to three years. This is a serious handicap to industrial progress, and in cases where the invention has a transient value, may operate to nullify the value of the patent. It is a national burden inasmuch as several organizations may at considerable expense duplicate research work in ignorance of what has already been accomplished and lies buried in the Patent Office.

A FURTHER DIFFICULTY arising from the lack of an adequate staff is that men without experience must be used in transacting the work of the Office including the preparation of Actions, viz., letters which relate to the allowance or rejection of pending applications. The Primary Examiner is assumed to review all such work but where he is already carrying an overload and his staff includes a number of green men this is next to impossible.

The obvious remedies are to increase the personnel and diminish the turn-over occurring in the Office. An immediate increase of two or three hundred in the working staff would be beneficial and the country at large would probably benefit if the staff were doubled. The turn-over is a more difficult problem. The staff is principally recruited from the ranks of recent college graduates with engineering degrees. These men start in with salaries of $2,000 per anum. Advancement is fairly regular until a grade of about $3,000 per annum is reached. From then on progress in salary is apt to be rather slow as it can only occur on accession to one of a limited number of higher positions. At this point the worker, confronted with slow progress in the Patent Office, finds that he can obtain immediate advance by transferring to a firm or corporation and it is from this grade that a substantial proportion of the defections occurs.

Hope has been expressed that the situation would be ameliorated by a general increase in salaries which became effective in 1928. I do not share this view. Private firms and corporations are certain to compete with the Office for men and regardless of the salaries which the Office has established will attract considerable numbers. It may be possible to help the situation by permitting raises, within the discretion of the respective department heads, in excess of the present schedule. This would probably require a revision of present civil service regulations in so far as they apply to the Patent Office. A further improvement might result from requiring a stipulation from entrants to the Patent Office committing them to a definite period of service. A minimum of at least three and possibly four years of service should be required.

The Office should be provided with adequate facilities for testing and demonstrating inventions; at present no adequate provision is made for this purpose although a demonstration would frequently clear up disputed points and eliminate delays of several months.

PATENT PROTECTION: Litigations relating to patents are conducted in the federal courts. Statutory provision is made either for trial at law before a judge and jury or for an equity trial in which all questions both of fact and law are determined by a judge. The latter procedure is almost invariably followed as it is more flexible and permits certain summary remedies such as injunctions and accountings. The judges are not ordinarily men of technical training and are conversant with tech-

nical matters only througn previous contact with patent cases. While their decisions are in the main correct the system is objectionable in that it imposes an avoidable expense upon litigants. It is seldom sufficient to present the facts concerning the patent involved. The attorneys must in practically every case prepare to educate the court to a point from which the technical aspects of the case can be appreciated. This is usually accomplished through the medium of experts who command relatively high fees, and the necessity for educating the court, by increasing the *per diem* expense, and the total time required to try a case constitutes a serious objection to the system.

THUS, if the case concerned a device for rectification it would be necessary to start by describing the elementary principles of distillation and through experts detail the entire development of the subject. A period of days might easily be consumed in this fashion. It will be conceded that a similar effort would be involved even though the court were possessed of technical qualification, but the time required would be much shorter and the impression obtained by a court so trained more accurate. There is always a chance at present that the most elaborate educational program produces in the court's mind only a vague resemblance to the facts as appreciated by an engineer. Many judges are quick to appreciate technical points and render admirable decisions but taken as a whole the present situation leaves much to be desired.

Occasionally the lack of technical training or aptitude is so great that further difficulties are encountered. I have in mind a recent case which involved machine construction. The parties were seriously handicapped by the fact that the judge was not capable of reading blueprints and great difficulty was experienced in conveying the salient points to him.

Some judges because of their unfamiliarity with technical matters are incapable of distinguishing between an expert who is telling the truth and one who has worked up a plausible narrative. An example in point is a recent case which involved the measurement of temperatures. One side relied on a thermo-couple method which was obviously correct within the limits of error involved. The opposition relied upon a method which had never been demonstrated in application to the subject matter involved and which represented little more than a theory worked up by its expert. After hearing the two sides the court declared itself unable to decide and called for outside assistance. The case was adjourned and a government department called in, which of course, substantiated the accuracy of the thermo-couple method. Although the eventual decision was correct it was only obtained at considerable delay and expense, and similar situations may easily eventuate in incorrect decisions.

ANOTHER inherent difficulty at present is that some judges are timid about reasoning from established principles and are for that reason reluctant to invalidate a patent covering a claimed invention which to the technically trained mind appears inferential from the prior art. Because of this fact the industries regard it unsafe to leave anything unpatented which is not specifically described in the prior art and rush into the Patent Office with applications covering every possible development including those merely engineering in character. To a large extent this policy is defensive; the particular industries do not usually contemplate enforcing these patents but acquire them so that no one else can obtain a corresponding patent with which to threaten them. Such a procedure imposes a serious handicap on industry at large. It entails avoidable expense, burdens the Patent Office and the courts with extra work and frequently blocks industrial growth along important avenues of engineering development. The smaller companies suffer most severely because they cannot afford the large sums required for litigation and a patent of questionable validity is for this reason just as effective a bar to them as one of conceded merit.

The entire situation requires very serious study and many changes will be necessary to cut down the expense and delay which at present characterize patent litigations. One change which is entitled to serious consideration is the establishment of special courts for patent cases in which those who preside are selected because they possess both legal and technical qualifications. Either technical or legal qualifications alone appear insufficient. The subject matter of most patent cases requires technical training for its complete and prompt understanding but questions of general law, evidence and public policy are also involved which require legal training. The change suggested has a record of successful performance abroad and there are many reasons to believe that it functions more promptly, economically and certainly than our own system. It seems reasonable to urge that the qualifications of those who sit in final judgment upon patents should be at least as inclusive as the qualifications of patent attorneys in general.

IF ONLY ONE presiding judge were provided to a court, cases could be routed before a judge familiar with the technology involved but it would probably be better to provide each court with a bank of three judges drawn from different technical fields such as mechanical, electrical and chemical engineering. A very similar system obtains in some of the German courts.

The federal courts which try patent cases are called district courts and appeals from these courts are taken to the circuit courts of appeal, in which each case is reviewed by judges whose training is also usually exclusively legal. This system of appeals is subject to criticism very similar to that directed against the lower courts. During the trial of a case the judge may acquire an appreciation of its technical aspects from the experts and fact witnesses. The appeal court has no such opportunity. Counsel frequently take advantage of this by emphasizing an aspect of the case which would have been promptly explained if urged before the trial court. It is difficult to present such explanations on appeal because the record is closed, the witnesses cannot be recalled and the court is not familiar with the basic scientific principles which may be involved. Cases are not infrequently overturned on appeal on mis-conceptions of this sort. The provision of a separate court for appeals in patent cases, presided over by judges with both legal and technical training is worthy of serious consideration.

If such a court were established further appeals would doubtless be carried as at present to the Supreme Court of the United States. The technical questions are usually well disposed of at this stage and in any event the Supreme Court is composed of men of exceptional insight even when intricate technical matters are involved. Their decisions uniformly recommend themselves to the engineer as examples of correct and accurate determination.

Commercializing Propane and Butane

Industrial development of the "wild" end of natural gasoline

RECOVERY of natural-gas gasoline by all processes produces a mixture of hydrocarbons which includes some propane and considerable butane in the liquid product. These constituents are not desired in the gasoline fraction because of their high volatility, which renders the gasoline "wild." Elimination of these constituents by weathering of natural gasoline was formerly practised, but this system resulted in a large loss of the desired hydrocarbons, including much pentane and considerable hexane. A variety of methods for the controlled fractionation of wild gasoline were therefore developed, as a result of which the recovery of propane and the butanes was possible, either mixed or, by refractionation, as separate products.

These liquefied petroleum gases have recently assumed substantial industrial importance for a variety of purposes. The properties of two commercial grades as described by Philfuels Company, one of the producing concerns, are given in the tabulation below.

One of the earliest applications of these liquefied gases was for household fuel use as a substitute for city gas. Such applications are naturally restricted to the areas in suburban and country districts which are beyond the reach of city-gas supply. Under present conditions this would correspond, in actual cost to the customer, approximately to city gas at $2 per thousand cu.ft., assuming a 530 B.t.u. manufactured gas. Similar application has been made in a number of cases for isolated laboratories and other limited-scale uses. In general the propane fraction is preferred for this use since it is self-vaporizing at all temperatures ordinarily met and the character of the gas varies but slightly from the start to the finish of use of a single cylinder.

Industrial heating applications with the liquefied gases have been made on a considerable scale experimentally in a variety of plants. Some producers recommend the butane mixture (normal and iso compounds) for this purpose. If it is assumed that 3.7 cents per gallon be allowed for freight and storage charges a cost comparison on equivalent thermal basis between such liquefied butane and 530 B.t.u. manufactured city gas shows the following cost relation: At seven cents per gal. for butane,

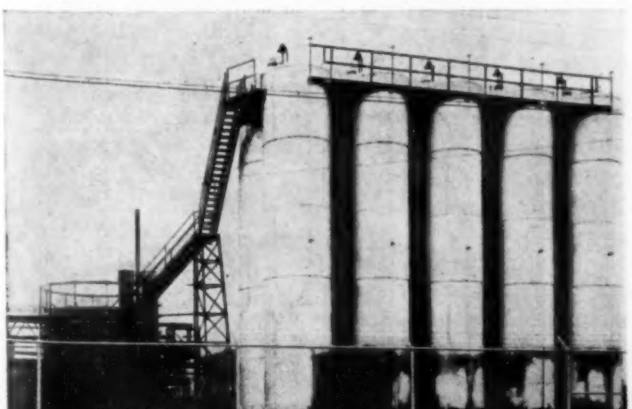


Fig. 1.—Storage Tanks Installed By a Gas Company for Meeting Periodical Peak-Load Requirements

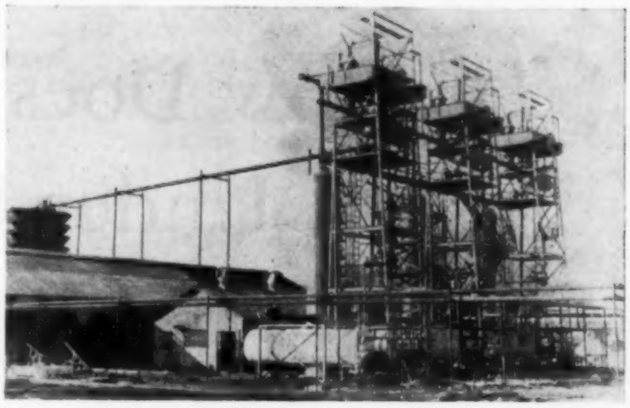


Fig. 2.—Liquefied Petroleum Gas Plant With Daily Production Capacity of 50,000 Gal.

f.o.b. producing point, the cost at the burner would be 10.7 cents, equivalent to 55.3 cents per M of city gas.

A number of reports have been made on the use of propane and butane as an enricher for blue gas to be used in city-gas supply (cf. *Chem. & Met.,* Nov., 1928, p. 666). The most elaborate experiments on this subject have been carried out in co-operation with the U. S. Bureau of Mines and were reported by Mr. William W. Odell, who is in charge of the field work for the Bureau. His results indicate that this procedure is entirely practicable technically and that the extent of this industrial development will depend largely on the relative cost of the delivered liquefied hydrocarbon and of gas oil for carburetting.

In one case a city-wide experiment was made (at Linton, Ind.) to determine whether the vaporized butanes might not be used in an air-gas mixture for city supply instead of as a cold carburetting medium with blue gas.

Several companies are now regularly producing and marketing liquefied hydrocarbons of this sort. It has been estimated by one of these producers that during 1928 approximately 7,000,000 gallons were manufactured, and it is forecast that this output will be considerably increased during the present year. A number of industrial uses, for manufacturing chemical compounds, for refrigeration, as solvents, etc., have been suggested in addition to the fuel applications.

Properties of Two Grades of Liquefied Petroleum Gas

	Propane	Butane
Vapor pressure lb. per sq.in. gage		
at 70°F	120	33
at 90°F	165	53
at 100°F	195	65
at 1[illegible]5°F	210	71
at 130°F	300	110
Temp. at which pressure is 0 lb. per sq.in. gage, °F.	—44	15
Specific gravity of liquid (water = 1)	.509	.576
A.P.I. gravity of liquid, °A.P.I. 60/60°F	146.4	114.2
Initial boiling point, °F	—45	12
Final boiling point, °F	—40	30
Weight per gallon of liquid in lb.	4.24	4.8
Mean Coefficient of Thermal Expansion		
From 0°F. to 50°F	.001316	.000908
From 50°F. to 100°F	.00174	.00118
Specific gravity of gas (Air = 1)	1.523	1.95
Specific heat of vapor at 60°F. (cp)	.475	.458
Dew point at 14.7 lb. absolute, °F	—44	26
Cu.ft. of gas per lb. of liquid	8.49	6.7
Cu.ft. of gas per gal. of liquid	36	32
Maximum limits of flammability (bulletin 279, Bureau of Mines, table 26)		
Gas per cent in gas-air mixture for lower explosive limit	2.4	1.9
Gas per cent in gas-air mixture for max. rate of flame propagation	4.7	3.6
Gas per cent in gas-air mixture for upper explosive limit	9.5	8.5
Heating value		
B.t.u. per cu.ft.	2,550	3,200
B.t.u. per lb.	21,650	21,420
B.t.u. per gal.	91,800	102,400
Latent heat of vaporization at boiling point		
B.t.u. per lb.	186	170
B.t.u. per gal.	788	830

How Does CO_2 Behave Under Pressure?

A preliminary study of the possible industrial applications of carbonic acid when used at moderate pressures

by Norman W. Krase and J. B. Goodman
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THE PRESENT work was undertaken for the purpose of studying the properties of carbonic acid. It is well known that dilute solutions of CO_2 in water are only slightly acidic. Acetic is a much stronger acid than carbonic at atmospheric pressure and there is no difficulty in dissolving carbonates in acetic acid with the resultant displacement of carbonic acid from its salt. That carbonic acid solutions become more corrosive toward metals as the pressure of CO_2 is increased is also a well known fact. A determination of the strength of carbonic acid at high pressures of CO_2 is important for several reasons. In the first place it is difficult to conceive of a cheaper acid than that made from CO_2 and water. The development of uses for acid made from such cheap raw materials is, therefore, attractive. In addition to the possible industrial applications there are many interesting theoretical problems that depend on data of this kind.

Equilibria involved may be considered as follows:

$$CO_2 + H_2O \rightleftarrows H_2CO_3 \rightleftarrows H^+ + HCO_3^- \rightleftarrows 2H^+ + CO_3^{--}$$

At ordinary pressures of CO_2 we are limited to dilute solutions and consequently to small concentrations of hydrogen ion. As the concentration of CO_2 is increased due to an increase in pressure, it is logical to expect a higher concentration of hydrogen ion and a corresponding increase in the strength of the acid. There are several methods of determining the strength of aqueous acid solutions. For a number of reasons we have selected the following reaction as a means of study:

$$Ca(C_2H_3O_2)_2 + H_2CO_3 \rightleftarrows CaCO_3 + 2HC_2H_3O_2$$

At ordinary pressures, calcium carbonate dissolves readily in acetic acid with the formation of calcium acetate, CO_2 and H_2O. As more and more CO_2 is brought into solution by the application of pressure the tendency to dissolve calcium carbonate decreases. It is conceivable that the normal direction of the reaction above (toward the left) might even be reversed by sufficiently high pressures of CO_2. This accomplishment would make it possible to displace acetic acid from its salts by the use of carbonic acid. This displacement of acetic acid would continue until the strength of the liberated acid became equal to the strength of the carbonic acid present.

This method of comparing the strength of acids is simple and direct and, moreover, well adapted to the use of high pressures. Other variables such as temperature are known to affect the strength of acids and a reaction of the kind given above can readily be studied over a range of temperatures and pressures.

Some work has already been reported. Ipatiew [*Jour. Russian Physical Chemical Society*, Vol. 45, page 992 (1913)] subjected a number of solutions to the action of CO_2 under a pressure of about 800 lb. and at about 90 deg. C. In one case he recovered one gram of $CaCO_3$ from 50 cc. of a 12 per cent solution of calcium acetate after seven days. Barium and copper salts also gave precipitates of carbonate but nickel salts did not.

THERE IS some doubt that Ipatiew secured benefits of his experiments since the methods of experiment and analysis are not given in detail. It is obviously desirable to analyze the resulting solutions in such a way that no change occurs during sampling, etc. If, after the experiment, the pressure is released and the solution removed and analyzed, incorrect results will be obtained. For example, in the reaction between calcium acetate and carbonic acid, the instant the pressure is released the strength of the carbonic acid decreases and calcium carbonate will redissolve in the acetic acid. The results obtained will depend on the speed with which these operations are performed. Accordingly, an apparatus was designed to accomplish the separation of the components of the reaction mixture without release of pressure.

Fig. 1 shows in outline the essential features of the apparatus used in the preliminary study of the use of carbonic acid under pressure. *A* is the usual CO_2 cylinder containing liquid at about 800 lb. pressure at ordinary temperature. For experiments at this pressure the cylinder is connected directly to the top of the bomb *C* which contains the solution to be treated. For work at higher pressures the CO_2 cylinder is inverted and connected to bomb *B* as shown. This makes it possible to fill *B* with liquid CO_2 at about 800 lb. pressure. The valves connecting the two bombs are then opened and as *B* is heated the pressure rises, subjecting the solution in *C* to the higher pressure. It is of course necessary to warm the solution in *C* above the critical temperature in order to prevent condensation of liquid CO_2 in *C*. The pressures in *B* and *C* are indicated on the two gages. Thermometers placed in holes drilled in the steel walls of the bombs register the temperatures. When it is desired to agitate the solution in *C* a small amount of gas is allowed to escape through the side outlet valve. This

causes gas to bubble through the solution. For most work it is desirable to use a glass test tube in *C* to keep the solution out of contact with the steel. Approximately 350 cc. of solution may be used conveniently.

For reactions involving the formation of a precipitate such as, for example, the precipitation of calcium carbonate from an aqueous calcium acetate solution, it is desirable to be able to filter the resulting suspension without releasing the pressure. This filtration is accomplished by means of the pressure filter *D* connected as shown. A porous alundum plate covered with filter paper is a satisfactory filtering medium. This plate is shown cross-hatched at *E*. Rubber composition gaskets are used on each side of the alundum to prevent passage of solution around the plate and to prevent cracking the plate when the lower end of the filter is bolted on. By opening the valve between *D* and *C* and closing the valve between *C* and *B* the solution is forced into *D* and may be filtered at any desired rate by regulation of the valve

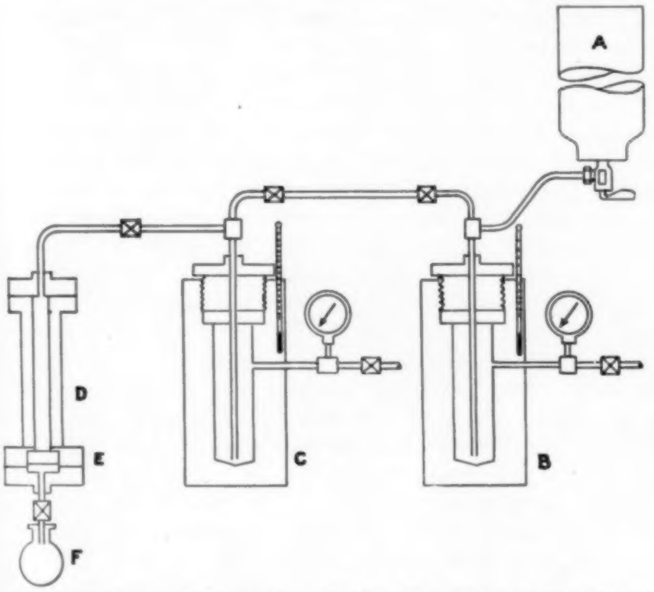

Fig 1—Features of Apparatus Used in the Study of the Use of Carbonic Acid Under Pressure

at the lower end of the filter. The filtrate is collected in the flask, *F*, for analysis.

In order to obtain preliminary data that would indicate the possibilities in the use of carbonic acid, a short series of reactions involving the precipitation of calcium carbonate from calcium acetate solutions was undertaken. Three experiments at 800 lb. pressure and one at 2,400 lb. pressure were performed. The temperatures ranged from 20 deg. C. to 200 deg. C. The table shows the results. In all cases a solution containing 17.5 per cent of calcium acetate by weight was used. The results are shown graphically in Fig. 2.

In the case of experiments at 800 lb. pressure the filtrate collected in the flask *F* was refluxed to remove the last traces of dissolved CO_2 and an aliquot portion taken for titration. Approximately $\frac{1}{10}$ N alkali was used with cresol red as indicator. In the experiment at 2,400 lb. pressure, the solution was sufficiently acid to attack the steel tubes and the wall of the pressure filter. A considerable quantity of iron in the filtrate made it necessary to distill the solution and then titrate as before. To prevent corrosion and contamination in subsequent work all metal parts were copper plated and copper lined tubing was used.

It appears that there are attractive possibilities in the use of compressed CO_2 as an acid. At moderate pressures and temperatures it has been possible to produce approximately ten per cent acetic acid by displacement from a salt. In this experiment, also, about 77 per cent of the calcium present was precipitated as carbonate. If a more dilute solution of calcium acetate were employed it should be possible completely to remove the calcium from solution and to produce a solution of acetic acid in water. Such a solution could readily be concentrated by distillation.

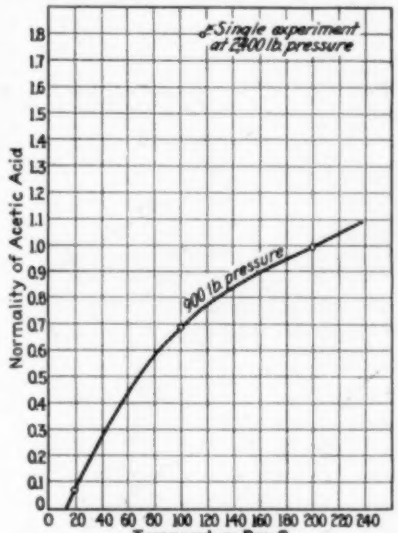

Fig. 2—Graphical Representation of Preliminary Data Indicate Possibilities in the Use of Carbonic Acid

There are numerous cases in the chemical industries where fairly dilute acids must be used to promote reactions. It is then frequently necessary to neutralize the acid to recover the product. If this neutralization results in the formation of a precipitate, a filtration step is involved. With the use of a volatile, unstable acid, such as carbonic, simply releasing the pressure removes the acid and no further steps are necessary. The conversion of starch to glucose is a case in point. Hydrochloric acid is frequently used to cause this hydrolysis. Neutralization and evaporation yield a product containing sodium chloride. With carbonic acid pure glucose should result. A long list of reactions involving hydrogen ion as a catalyst could be written. Many of these might profitably be investigated from this new angle. This laboratory has under way and in prospect the study of several reactions of this nature.

Preliminary Data Indicating Possibilities in the Use of Carbonic Acid

Pressure Lb. per sq.in.	Temperature Deg. C.	Duration of Hours	Normality of Resulting Acetic Acid Experiment	Strength of Acetic Acid Solution, Per Cent by Wt.
800	20	24	0.0732	0.42
800	101	23.5	0.687	4.3
800	200	24.5	1.0004	6.4
2,400	115	15	1.81	9.98

Soap Dust a Serious Explosive Hazard

SMOOTH, flaky soap powder, which plays so great a part in the work of keeping the world clean, is, when suspended in air, a highly explosive substance, capable under certain conditions of causing a serious explosion.

Tests conducted at the Pittsburgh, Pa., Experiment Station of the Bureau of Mines, with soap dust in suspension produced even more violent explosions than were attained with dry coal dust, which, as is generally known, has been responsible for many violent coal-mine explosions. The explosive hazard of soap dust is, of course, a serious factor only in the case of suspension of considerable amounts in air, as might occur in the process of manufacture, states the Department of Commerce.

How a Little Periodical Serves a Consultant's Public

By Arthur R. Maas

President, Arthur R. Maas Chemical Laboratories, Los Angeles, Calif.

TWENTY YEARS AGO we opened a modest laboratory in Los Angeles to serve the community as analytical and consulting chemists. We were not certain that the community wanted our professional services to an extent that would pay rent and grocery bills: at that period, fortunately, we were not bothered by the up-keep of motor cars.

My own experience as chemist for one of the large wholesale drug houses brought us some clients. The district attorney's office sent us analytical work, the courts sometimes called us in to give technical testimony, a few lawyers and doctors understood how valuable our knowledge could be.

But our real ambition was to serve industry,—and at that period there was very little industry in Southern California. Oil was just looming up, the movies were arriving, the city washed its own clothes, supplied itself with candy and soap, and so on. But there was almost no manufacturing. The one outstanding industry was the tourist business, and the tourist required almost no chemical attention.

Evidently, we needed advertising. We believed in advertising, and as far as our few spare dollars permitted we published professional cards in local journals likely to be read by the business men who needed us, but did not realize it. The results, however, were not very encouraging. At that time the *Industrial Bulletin* of Arthur D. Little, Inc., came along with its short articles about the wonders that the chemical consultant could perform for business. We saw that what our community needed was "education" which would lead it to appreciate the marvelous things we were ready to do for it. And so, a little 4-page publication was launched, under the title of *Chemistry & You,* indicating that we would talk about chemistry and its application to the problems of business folks in Southern California, and perhaps talk a little about ourselves.

STARTING such a publication is easy enough. Every member of our small staff had something to contribute to the first issue. Keeping it going, however, is another matter: few technical men have the trained writer's nose for news that scents interesting incidents in the daily routine of laboratory work.

We told our public, in the early issue, about Dry-Ice; the nature of bacteria in drinking water; the chlorine sterilization used by Los Angeles; our work on boiler scale, soil corrosion of iron pipe, change of flavor in a bottled beverage, wearing qualities of paints, analysis of gas from an oil well, air from the hold of a ship, alkali from a fruit ranch; our production of artificial clouds and fog for moving pictures; our formula for smoke bombs to be thrown into a crowd of movie "extras" without danger to them; our work on bullet holes in clothing, in criminal cases, and so on.

One problem of that time we reported with particular pride: Large quantities of walnuts are cracked by machinery in Los Angeles. The shells were thrown into the Los Angeles River. Now, the Los Angeles River flows upside down. Its waters are below the river-bed, a peculiarity of Southern California rivers in general. So the shells stayed on the river, the city authorities protested, and we were retained to find some industrial use for this waste material. Exactly the kind of problem we had been seeking! And after due research, we recommended that these shells be turned into charcoal and sold to poultrymen, as conditioner for the flocks of laying hens that make up a large industry round the city.

No regular period was set for publishing our little "organ," and after the first half-dozen issues, appearing during the course of a year, we began to be "stumped" for copy. Our laboratory practice was growing, people spoke appreciatively of *Chemistry & You* as an interesting little paper they liked to read, and we had material for articles,—but not the ability to put it in readable shape as often as we wanted to. To me fell the task of "make-up man," and I carefully estimated the amount of space each little article would take, in type, before sending the manuscript to the printer. So the thought of counting words and figuring space often led to the editorial work being postponed.

ONE day my friend James H. Collins, whose work as a writer is well known, asked why *Chemistry & You* was not issued oftener. I told him about my difficulty in counting words, and he laughed, and offered to get out an issue of the paper, showing how a professional writer does such work. The upshot was a request that he get it out regularly, and since that time, about two years ago, *Chemistry & You* has averaged ten issues a year. During this period our laboratory practice has steadily increased, so that we are now planning to erect a building of our own. To be sure, the industrial enterprises of Southern California have been growing, too. But we feel that *Chemistry & You* has kept us before people, given them some idea of what we do, shown them that many of their problems not considered chemical are really within the province of the chemist or the chemical engineer, and thus we have been linked with the industrial growth.

Having told how it came about, I shall now tell how our little publication works for us, incidentally answering some of the numerous questions that have been asked by chemists in various parts of the country. First of all, it is readable and brief. The leading article runs only 400 to 500 words, or about the length of a double-spaced

letter running to half a second page. We publish two or three short editorial articles about work we have done, and maybe a half-dozen still shorter digests of chemical interest. There is a cartoon, and a joke department, and our own "Ask Me Another" with questions about industrial chemistry. These questions are used in the Los Angeles public schools, by the way, and several times I have been approached by small relatives who expected me to reveal the answers before publication!

People read the little paper; we know this because if there is too long a delay in getting it out we receive inquiries, asking if their names have been dropped from the mailing list. The size is six by nine inches, so it is convenient for the pocket, and one thing we do know is, that people read it.

Next, we know that it makes friends. People read about our work, get a glimpse of our methods of tackling problems, spend ten or fifteen minutes with us in the laboratory every few weeks and feel that they know us, and that results in a definite attitude of friendliness. In business, the people whom we can regard as friends are the ones we know something about, while unfriendliness is usually based on lack of knowledge. Through this little paper we multiply our contacts beyond anything that would be possible in this hurried business world, and people learn more about us than we could tell them, generally, if they visited our laboratory.

Our circulation is from 2,500 to 3,500 copies per issue, depending upon circumstances. We have a regular mailing list of about 2,000 names, and each issue is planned to reach some special industry, trade or profession as well. Last year, we published nine numbers and they were mailed to special audiences numbering from a few dozen to several hundred business concerns; for each of these special audiences we gave some chemical information in the leading article, such as these:

1. Problems of the modern moving picture laboratory. 2. The help the chemist can give the buyer of merchandise. 3. Household insect pests and non-poisonous insecticides. 4. What Uncle Sam requires in labeling under the pure food and drug act. 5. The help the chemical consultant can give in unjustified law suits, alleging damage by cosmetics and so forth. 6. The correct financial treatment of chemical and engineering research in a business, charging the cost to capital addition instead of expense.

Our regular mailing list includes business houses, professional men, teachers and others all over the country, persons who have heard of *Chemistry & You* and asked for it; but the main circulation is in and around Los Angeles. We have to watch this list to keep it free from people outside our field, for it grows quickly. Names are dropped if people do not return a request card sent out every few months. The special lists are made up in various ways, from the telephone book, business lists obtained from friends, and so on.

The cost of the publication, including everything from editing to mailing with an addressing machine, averages from five to six and a half cents a copy, according to the number mailed.

This is by far the best form of advertising we have succeeded in developing, to fit both the consultant's pocketbook and his ethical dignity. It is, essentially, telling people something about chemistry of the kind that our community needs, and incidentally telling something about ourselves. I am convinced that if we told more about our side, and less about the public's it would lose its value for both of us.

We have also found it unwise to dilate upon "the wonders of chemistry," and in our experience there may be a hint for the general propaganda of the profession. When we first opened a laboratory in the Southwest, people thought we were some kind of super-druggists. Now they know better. But so much appears in the general press about the wonder, and magic, and medicine - making side of chemistry, that we were regarded as legerdemain artists, prestidigitators and handcuff kings, capable of getting out of any technical predicament in a very little while. Expecting wonders from the chemical consultant, business men do not consult him until they are actually in trouble and "in bad." And having told him their troubles (perhaps reserving some of the cardinal points as "confidential information"), they expect him to have a complete solution tomorrow morning.

On this account, we have stressed the amount of detailed work involved in research, the complexity of what may seem simple problems and troubles, and the wisdom of making chemical control a routine part of every business, so that formulas, materials and processes will be regularly checked, and all difficulties of every character submitted to the chemist as soon as they show their heads, even though they may seem to be entirely non-chemical in character. It is hoped that the feature articles, such as those enumerated before, will help to convey to their special audiences the real extent of the permeation of chemistry through all branches of even their work; the doctrine of "an ounce of prevention" will introduce itself through its own force.

Besides our laboratory practice, we have a separate corporation manufacturing photographic and other chemicals consumed in our community. In December, we decided to begin talking to the public about this side of our work, and for that purpose a modest two-page leaflet has been added to *Chemistry & You.* It tells little stories about what we make, and what our customers accomplish with our factory products. It has a more direct selling objective. We were in some doubt as to what to name the new leaflet, which is slipped into *Chemistry & You,* but printed on paper of a different color. Finally, we hit on a name that seemed to reveal the frank commercial motive, calling it *Chemistry & Us.*

Chemical Engineer's Bookshelf

The Higher Alcohols

Glycerol and the Glycols. By *James W. Lawrie*. The Chemical Catalog Company, Inc., New York, 1928. 447 pages. Price, $9.50.

Reviewed by Arthur W. Hixon

If it may be said of any chemical product that it has a catholicity of use it certainly may be said of glycerol. That is sufficient justification for the publication of a monograph.

In this book has been assembled a digest of practically all of the published and available (?) data on the important alcohols whose names make up the title. Fourteen of the fifteen chapters are devoted to glycerol. The first four chapters are concerned with the history, sources, older methods of production and the rather well-known processes for the recovery of glycerol. In Chapter 5, for the first time, as far as the reviewer is aware, the widely scattered and sketchy literature on fermentation glycerol has been brought together, classified and interpreted. Following a discussion of the theories of fermentation are descriptions of fermentation processes which have been taken largely from patent literature. The chapter is concluded with a description of analytical methods and process for glycerol recovery.

The remainder of the book with the exception of the chapter on the glycols is concerned with the physical properties and constants, chemistry and reactions, tests for detection, quantitative estimation, standard specifications, commercial utilization, statistics covering production prices, and a word about the future — all of glycerol. There is also a chapter on the manufacture of nitroglycerol and an appendix dealing with the determination of nitrogen by the nitrometer method.

The comparatively recent advent of the glycols into large industrial importance makes their consideration in the monograph timely. In this day when emphasis in industrial research is put upon finding new uses for the products of well established processes there is need for having available complete information concerning such products. This book gives that kind of information about glycerol and the glycols. It is well written and will be useful in the research laboratory and in the plant.

In view of the fact that the production of glycerol by fermentation is an established factor in that industry one does wish that the author had made the chapter on "Fermentation Glycerol" more complete from the Chemical Engineering standpoint.

* * * *

Impurities and Metallic Properties

Impurities in Metals. By *Colin J. Smithells*. John Wiley & Sons, Inc., New York, 1928. 157 pages. Price, $5.

Reviewed by Ancel St. John

This timely book merits careful attention by those concerned with the manufacture and use of metals. It presents in brief and lucid form authoritative information and data concerning the influence of "impurities" or, as the author prefers to call them, "minor constituents" on the structure, the mechanical properties, the electrical properties and the chemical properties of metallic materials. The presentation is preceded by an excellent survey of the methods of studying the structures of these materials, including a correlation of X-ray diffraction analysis and photomicrography.

The text is embellished with copious tables and charts presenting the data under discussion, with fine reproductions of photomicrographs, and with some of the best reproductions of X-ray diffraction patterns the reviewer has seen. The publishers are to be congratulated on the bookwork. A minor correction has been noted on page 54, line 13; the sense seems to require "liquid" instead of "solid."

The reviewer concurs with the author in preferring the term "minor constituent" to "impurity" but dissents from the statement in the preface that "There is no reason to distinguish between substances which may properly be described as impurities, and small amounts of elements which are intentionally added or allowed to remain in the metal." There is every reason to distinguish between those minor constituents which are preferably left out or removed and those which are preferably left in or introduced. The former are properly termed "impurities"; the latter, for want of a better term, might be called "improvers."

* * * *

Cost Control in Industry

Accounting and Cost Finding for the Chemical Industries. By *George A. Prochazka, Jr.* McGraw-Hill Book Company, New York, 1928. 242 pages. Price, $3.

Reviewed by A. G. Peterkin, Jr.

In the conventional corporation organization the cost department comes under the jurisdiction of the treasury and has too often been looked upon by its officials as affording merely a periodical "check" on the producing and marketing organizations, rather than, in addition, a running commentary and means of control. A natural corollary has been ignorance on the part of the operating executive as to the method of computing the cost figures and skepticism as to their accuracy and, on the part of the cost accountant, a superficial knowledge of the physical operations his statements are supposed to reflect.

Wherever the cost department acts as a "secret service" and "police bureau" the results have been, and are bound to be, disappointing. Its higher and more valuable function as an "intelligence department" is becoming widely recognized.

Mr. Prochazka sets forth the general principles of cost accounting, illustrates their application to an actual set of factory operations and the inter-relation of the cost and the general financial records. The illustration includes typical forms filled out with actual figures and depicts clearly the accounting record from raw material to finished product, and from money spent to profits realized. One must not expect too easy reading: to understand the result one must be willing to thread the labyrinth of form and figure.

The modern tendency towards the use of cost records as a means of studied analytical process control is well illustrated in the method of "standard cost," the framework upon which the author builds his statistical structure. Here is a system which shifts the emphasis away from tne occasional question: "How much per pound did it cost?", towards the more useful: "How much should it cost?"; "How much does performance vary from the ideal?"; and "What particular items of cost and yield were responsible for the variation?" The answers to these questions are spread on the records for the benefit of all concerned,—a long step away from the bad old habit of locking the safe door after the profits have flown.

In candor it should be stated that the author solves a relatively simple problem and occasionally gives evidence of a somewhat narrow experience. After reading the book our special perplexities remain, but we are convinced that the principles demonstrated are sound and usable. In a book presumably intended to appeal to the chemical engineer it is a disappointment to find not so much as a paragraph emphasizing the fundamental importance of accurate measurement in the plant itself, and of the necessity for providing adequate means for this purpose in plant design.

Mr. Prochazka's book should be a welcome addition to the bookshelf of the operating executive, chemical engineer, and technician generally. The volume is small; the treatment of general principles and of the more important phases of the subject is well-informed, concise, to the point, liberally supplemented by reference to more extended treatises, and pleasantly free from dogmatic statement.

* * * *

Are Sales Engineers Human?

The Sales Engineer. By *Gilbert Rigg*. Mining Publications, Ltd., London, England. 112 pages. Price, 12s.

Reviewed by D. Gayley Browne

A sales engineer is an engineer who thrives on trouble and whose peculiar make-up permits him, when sales engineering palls, to turn diplomat, operating executive, research chief, detective, or to any one of a dozen occupations, except selling. Such is the picture which Gilbert Rigg draws in this entertaining and instructive book.

Mr. Rigg draws most of the substance for his book from a lengthy and profitable experience with the New Jersey Zinc Company. His material has, therefore, a very pointed interest to anyone engaged in the production, use or sale of zinc or of those products which have come to be associated with it. To these men he brings a great amount of detailed help. By specific example he covers the troubles to which zinc is prone and tells of their solution in connection with such operations as paint and rubber making, drawing, slush casting and galvanizing.

Beyond all this, however, Mr. Rigg points out the essentials of successful sales engineering. That dangerous middle ground between producer and consumer, to which the sales engineer's operations are largely confined, must be walked with discretion and an open mind, and to his contacts with these extremes in opinion he must bring an unbiased fairness if he is to gain the confidence so essential to his work. Of such things Mr. Rigg speaks with authority and in a delightful style.

Colloid Chemistry, Vol. II.

Colloid Chemistry, Theoretical and Applied. Volume II, Biology and Medicine. Edited by *Jerome Alexander*. The Chemical Catalog Company, Inc., New York, 1928. 1029 pages. Price, $15.50.

Reviewed by Per K. Frohlich

As the title indicates, this second volume of Alexander's "Colloid Chemistry" is devoted to biology and medicine. The first volume dealing with subjects of a general theoretical nature appeared in 1926, and a third volume on the technological aspects of colloid chemistry is in preparation.

The individual subjects are discussed by "selected international contributors," making a total of 57 papers written by some fifty scientists from all over the world. As a matter of fact, the real value of this book undoubtedly lies in its international character, making available as it does, usually in well-written and concentrated form, the latest experimental results and views of leading foreign scientists whose work is not always readily accessible elsewhere. The reader is left with the impression that he is getting the expert's opinion on any subject which happens to be brought up for discussion. The obvious disadvantages of this type of text are, however, a somewhat arbitrary choice of subjects as well as a bewildering array of opposing views. While advantageous to the more mature reader capable of exerting his own judgment, the novice is apt to find himself lost in the controversy. On the other hand, it must be admitted that the numerous explanatory foot-notes and cross references inserted by the editor all through the book, while at times somewhat irritating, do much to eliminate the confusion. Besides, the editor deserves credit for having managed to avoid undue repetition among different authors discussing overlapping subjects, not an easy editorial task.

There are chapters by Bragg, Pauli, Willstätter and Bredig, as well as by other leaders whose names are less familiar to the chemist and the engineer. There is also a typical Alexanderian preface and first-chapter, dealing with everything from music and religion to a poem by Dryden and a queer concept of catalysis. Except for a few chapters which rightly belong in the first volume rather than in the present one (Chapters 4, 8 and 9), and some discussions of purely physical chemical character (Chapters 6, 7, and 14), the majority of the papers deal with biological and medical subjects. The latter, while not strictly of bearing on the problems within the realm of the chemist leaning towards engineering, in many cases constitute most fascinating reading. Thus, to those believing in the ultimate service of physical chemistry to the solution of the intricate phenomena of the life processes, it is gratifying to read such a statement as the following: "Tuberculosis should be studied mainly with reference to its relation to the physical chemistry of colloids. Although this point of view has as yet merely been opened up, we see that light has been thrown on the genesis of the malady. Without doubt it will yield still more valuable information for the therapy of tuberculosis . . ." (A. Mary, p. 375).

All in all a worthy contribution which undoubtedly will be welcomed by students of the chemistry of life processes. The chemical engineer, however, who found the first volume useful in the study of his problems, will be looking forward to the third volume on technological subjects—which, as already mentioned, is in active preparation.

Annual Survey of American Chemistry, Vol. III. Edited by *Clarence J. West* under the auspices of the Division of Chemistry and Chemical Technology of the National Research Council. The Chemical Catalog Co., Inc., New York, 1928. 384 pages. Price $3.

As an experiment by the Division of Chemistry and Chemical Technology of the National Research Council the first volume of the Annual Survey of American Chemistry received much adverse as well as commendable criticism. Its sponsors were not to be disheartened, however, and second and third volumes have been published.

The third volume like its predecessor is an improvement, a job well done. The policy of the editorial board has been continued of varying the subjects covered, the less active are treated every few years. Different authors have prepared the reviews, a commendable plan, which gives the reader the opinions of the various authorities. The research chemist and organization should get many valuable suggestions and ideas from this volume and owe much to Drs. Hale and West.

* * * *

Soap Technologists' Handbook

American Soap Maker's Guide. 3rd Edition. By *I. V. Stanley Stanislaus* and *P. B. Meerbott*. Henry Carey Baird & Co., Inc., New York, 1928. 709 pages. Price $10.

Sixteen years have elapsed since this handbook on soap has seen its last edition, the successful outgrowth of an experiment in publication for the soap technologist. At that time it still relied largely on German sources, hoping to make compendious completeness its particular *raison d'être*.

Meanwhile, as not a few original minds are pleased to inform us, times have changed; and so, necessarily, has the soap industry. These far-reaching changes it was the especial problem of the authors to incorporate in the present volume, which therefore necessitated a complete revision and rewriting. The product offered, then, is above all things comprehensive, considering its attention to hydrogenation, colloidal developments, synthetic perfumes, powdered and flaked soaps, and similar complements of present soap technology. The various product groups, including candles, are of course treated from all salient angles: raw materials and their treatment, and general and special technology during manufacture.

The merits of the work should appeal especially to the plant man: abstract science is used only as a last explanatory resort, and equipment and useful auxiliary facts are given conspicuous weight. A demerit, although it scarcely detracts from the factual content, is a lack of desirable care in typography and illustrative material.

* * * *

Handbook of Chemistry and Physics, 13th edition by *Charles D. Hodgman* and *Norbert A. Lange*. Chemical Rubber Publishing Company, Cleveland, 1929. 1214 pages. Price, $5.

Of the numerous useful handbooks that are devised to save time and patience for engineers this one has particular claims to broadness of service with its entrance into a thirteenth edition. Its present appearance is marked by the addition of new matter on specific gravity of liquids and solutions, of a section on ceramics, and of new alcohol tables. Just as in its previous editions, it seems really remarkable what has been done here in the way of extensive content, convenient size, and attractive appearance.

Materials of Construction

Die Werkstoffe für den Bau Chemischer Apparate. By *A. Fürth*. Otto Spamer, Leipzig, Germany, 1928. 220 pages. Price, 18 M.

German chemical engineers, it would seem, also feel the necessity for a monograph dealing exclusively and exhaustively with "Materials for the Construction of Chemical Equipment." In answering this need, Dr. Fürth eliminates from his discussion all auxiliary substances (fuels, lubricants, catalysts, and the like) and covers the remaining body of strictly constructional materials from two angles.

In the first section of the book it is the salient properties of materials in general that receive attention. This is allotted especially to the various physical phenomena and more briefly to the chemical properties, which are principally concerned with corrosion and are treated more in detail in the second section. The behavior of a substance under various mechanical stresses, temperature conditions and electrical influences is of relatively great importance, hence the determining factors for its eligibility are thoroughly analyzed.

The second section of the book is devoted to individual discussions of constructional materials. Besides practically all metals and a number of alloys, these also include glass, asphalt, ceramics, carbon, wood, rubber and plastics. In general the author supplies all information of practical interest, such as derivation, properties, application, and cost; within the limits of one volume his attention to detail is perforce restricted, but in a monograph this apparent shortcoming should prove a benefit, the more valuable because of its embodiment of recent developments.

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Recently Arrived

Mathematical Tables and Formulas. By *P. F. Smith* and *W. R. Longley*. John Wiley & Sons, Inc., New York, 1929. 66 pages. Price, $1.60.—Complete and useful for engineers frequently dependent on higher calculation.

American Society for Testing Materials, Proceedings of the Thirty-first Annual Meeting, (Atlantic City, June, 1929). Published by the society, Philadelphia, 1929. Two volumes, 1184 and 904 pages. Price: each $6.50, cloth; $8, half leather.—Part I contains annual reports of 45 committees on research and standards; Part II comprises 46 technical papers of pertinent content on materials of construction.

The Profession of Engineering. Essays. Edited by *Dugald C. Jackson, Jr.* and *W. Paul Jones*. John Wiley & Sons, Inc., New York, 1929. 124 pages. Price $1.50.—A unified set of essays signed by various prominent names, intended to depict the function and status of the engineering professions, collectively and singly, in the present scheme of things. John Hays Hammond delineates chemical engineering, and the book closes with an essay by Herbert C. Hoover.

Dizionario di Merceologia e di Chimica Applicata (Dictionary of Commercial and Applied Chemistry), 5th edition, revised. Vol. I, A-C. By *G. V. Villarecchia*. Ulrico Hoepli, Milano, Italy, 1929. 1223 pages.—Very thorough reference on all products even remotely chemical.

Standards Yearbook. 1929. Issued by the National Bureau of Standards. Published at the Government Printing Office. 1929. 401 pages. Price $1. This volume is the third in this series of annual reviews covering not only work of the Bureau of Standards, but also other standardization activities of the United States and of an international character.

Government Publications

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Simplified Practice Recommendations of the Department of Commerce on: Asbestos Paper and Asbestos Millboard, No. R19-28, 3d edition, 5 cents; Iron and Steel Roofing, No. R78-28, 5 cents; Stoddard Solvent (Dry Cleaning), No. CS3-28, 10 cents; Coated Abrasive Products, No. R89-28, 10 cents.

Citric Acid in England. Two Bureau of Foreign and Domestic Commerce Chemical Division Special Circulars as follows: No. 237, British Citric Acid Trade; and No. 244, Citric Acid Situation in England. Both by R. S. Castleman, Consul at London.

Recommended Specifications for Quicklime for Use in the Distillation of Ammonia from Ammonia Liquors Obtained in Coke and Gas Manufacture. Bureau of Standards Circular 373. 5 cents.

A High-Pressure Gas Compression System, by J. R. Dilley and W. L. Edwards. Department of Agriculture Circular 61. 10 cents.

X-Ray and Radium Protection, Recommendations of International Congress of Radiology. Bureau of Standards Circular 374. 5 cents.

The Classification of North American Coals, by A. C. Fieldner. Bureau of Mines Information Circular 6094.

Carbon Monoxide from Automobiles Using Ethyl Gasoline, by W. P. Yant and L. B. Berger. Bureau of Mines Serial 2908.

Treasury Department Regulations Relating to Consolidated Returns of Affiliated Corporations Prescribed Under Section 141 (b) of the Revenue Act of 1928. Treasury Department Bureau of Internal Revenue Regulations 75. 10 cents.

Market Research Agencies—A Guide to Publications and Activities Relating to Domestic Marketing, 1928 Edition. Bureau of Foreign and Domestic Commerce Domestic Commerce Series 6. 15 cents.

Census Bureau statistics on Superphosphates and Sulphuric Acid, preliminary mimeographed statement for 1928, giving comparative date for 1927.

Mineral production statistics for 1928—preliminary mimeographed statements from the Bureau of Mines on: Sulphur and Pyrites; World's Production of Crude Petroleum; and Petroleum, Petroleum Products, and Natural-gas Gasoline (United States).

Mineral production statistics for 1927—Separate pamphlets from Bureau of Mines on: Natural Gas, by G. R. Hopkins and H. Backus, 5 cents; Natural Gasoline, by G. R. Hopkins, 5 cents; Salt, Bromine, and Calcium Chloride, by A. T. Coons, 5 cents; Tin, by J. W. Furness, 10 cents; Talc and Soapstone, 5 cents; Anthracite, by O. E. Kiessling and H. L. Bennit, 10 cents.

Developed Water Power in the United States, January 1, 1929. Mimeographed statement issued by the U. S. Geological Survey.

* * *

A special report completed by the Bureau of Mines, compares the rate of growth of coal and the other principal sources of energy—oil, gas and water power. The graphs below show that while coal production in 1927 was far lower, the production of oil, natural gas and water power has been enormously higher than the war-time maximum.

The total of the energy from all sources in 1927 amounts to 24,742 trillion B.t.u.'s which is second only to 1926 as the greatest in the history of the country. Thus it will be seen that, while the consumption of coal has not advanced since the war, the total consumption of energy has increased.

The growing significance of energy sources other than coal is shown from the increased rôle of oil and gas from 12.9 per cent in 1913, 14.9 per cent in 1918, to 31.7 per cent in 1927. The share of coal declined in the meantime from 87.1 per cent in 1913, to 68.3 per cent in 1927. Water power, though growing steadily, contributed only 7.3 per cent as much energy in 1927 as did the fuels. Coal, of course, is still the major contributing source.

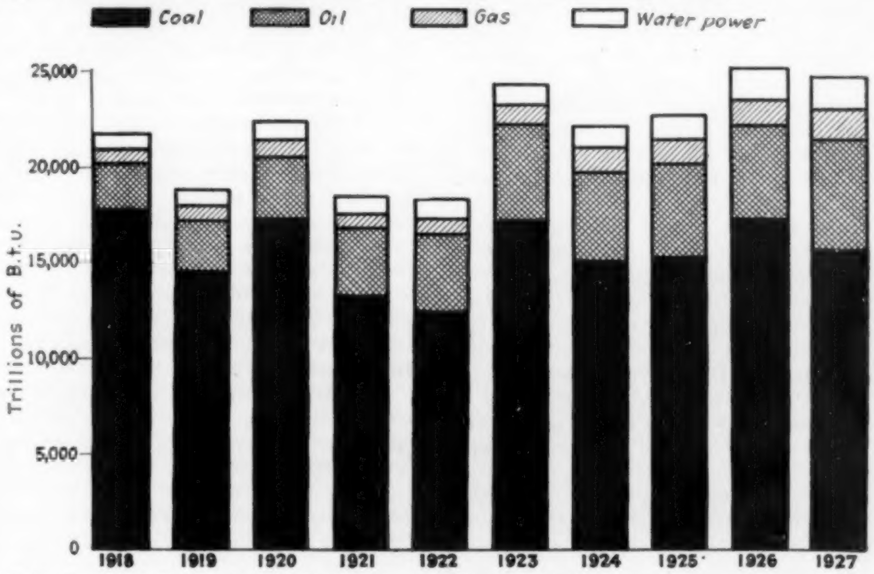


Fig. 1—Annual Supply of Energy from Mineral Fuels and Water Power in the United States.

Water power is represented by B.t.u.'s of coal necessary to produce the same amount of power. (Data from the Bureau of Mines.)

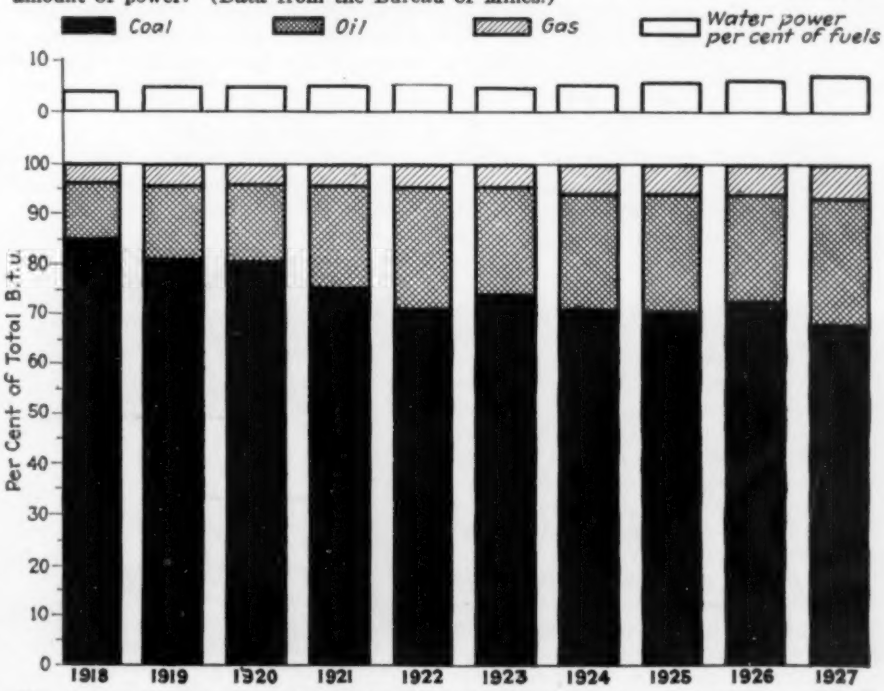


Fig. 2—Per Cent of Total B.t.u.'s Equivalent Contributed by Several Mineral Fuels in the United States.

The data for water power are expressed as per cent of the fuel total, but are not included in the base on which the percentage is computed. (Data from the Bureau of Mines.)

THE PLANT NOTEBOOK

an exchange for OPERATING MEN

Economic Advantages of Continuous Kilns

By L. T. Strommer,
*American Dressler Tunnel Kilns, Inc.
Cleveland, Ohio*

Tunnel kilns have been in use in this country for about 13 years and for a considerably longer time on the Continent. In this country alone they are being used in more than 30 distinct processes, ranging in temperature from the low heat of the decorating kiln to temperatures in the neighborhood of 3,000 deg. F., required for burning some of the newer types of refractories. This broad field is largely due to the flexibility of the first successful type of continuous tunnel kiln to be developed, the muffle kiln. During recent years, however, the direct or open fired type of continuous kiln has been improved and perfected to meet many requirements and can now be regarded as complementary to the muffle tunnel kiln.

The advantages of continuous kilns over the old intermittent method of burning are now generally recognized, but it is advantageous that they should be briefly summarized in one place. This summary will be conducted as a comparison between the modern continuous and the obsolete periodic method of firing.

Heat losses in the latter are due principally to a number of causes.

(1) The heat in exhaust gases, which obviously must be hotter than the ware being fired, is completely lost to the atmosphere.

(2) As it is necessary to cool the entire structure and its contents before it can be emptied and a fresh batch placed, all of the heat accumulated in the old style kiln, as well as in the ware is lost.

(3) It is very difficult, if not impossible, to prevent the flow of a large volume of excess air into the fire box, thus wasting fuel in order to create the necessary temperature.

(4) Little can be accomplished in insulating the periodic kiln to prevent heat losses by conduction and radiation.

On the other hand, continuous kilns materially reduce or completely eliminate these losses.

(1) In the tunnel kiln, whether in the muffled type in which the combustion gases are drawn through thin double walled combustion chambers for a considerable distance, or in the case of the open fired kiln, where the gases are drawn directly through the ware, maximum heat transfer is assured before the gas is withdrawn from the kiln. Thereafter, further recovery of the available heat in the gases may be made by use of a suitable recuperator for preheating the fuel or supplying heat for drying ware to be burned.

(2) As firing is continuous there is no heat loss due to repeated heating and cooling of the kiln. At the same time, the heat given off by the cooling ware is continuously given up to air drawn in for combustion while the excess heat is available for drying, heating, or other necessary purposes.

(3) In the comparatively small area of the combustion chamber, it is possible to obtain a very intimate mixture of fuel and preheated air, so that the air-fuel ratio is closely controlled. At the same time, practically any flame temperature may be reached.

(4) It is entirely possible to insulate tunnel kilns very thoroughly, insuring retention of the maximum amount of heat in the kiln proper.

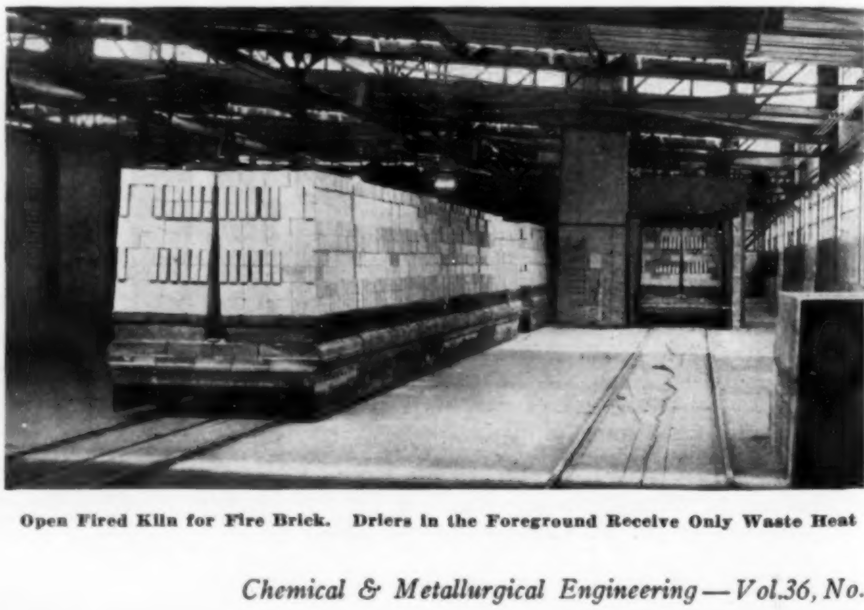
The net savings in fuel consumption for continuous, rather than periodic, operation will average about 50 per cent for all installations.

There are also other large improvements possible with continuous operation. In periodic firing, each burn is individual in itself, and the result is never known until the unit has been cooled and emptied. The results are thus wholly dependent upon the care, judgment and experience of the firemen. The difficulty of attainment of the desired final temperature throughout the kiln, and of a uniform rate of cooling to avoid damage to the goods, is inherent in the method.

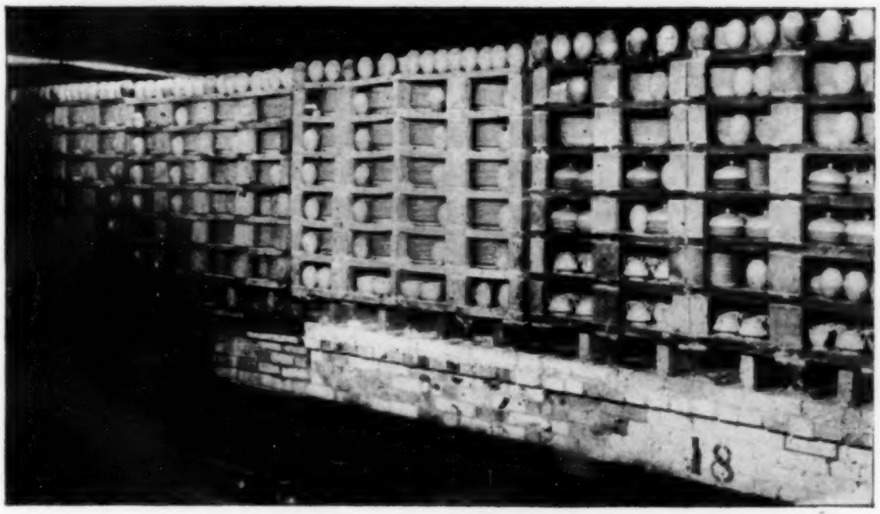
Another factor which reflects in the quality of the product is the extra handling which the ware must receive in the green state in periodic operation. A high percentage is always damaged. In continuous operation, however, the process readily lends itself to mechanical and automatic means for moving the goods, decreasing handling and the danger of damage to a minimum, at the same time permitting inspection for defects after the ware has been placed but before it has entered the kiln. And in the matter of temperature control and cooling, once a satisfactory temperature curve has been obtained and settings made to insure the best results, continuously uniform burns may be made as long as conditions remain constant. When conditions change, changes in the kiln settings are easily and quickly made. These factors result in improvement in quality of the goods, which is difficult to determine quantitatively, but from all data available the range is found to be from 3 to 20 per cent of the total value of the finished product.

Reduction in labor cost is another attractive feature of continuous operation. In periodic operation it is necessary to transport ware by semi-skilled labor, while setting in the kiln is done by skilled labor and at high wage rates. Handling the saggers in which the ware is fired more than doubles the labor cost as saggers must be handled and transported twice to four times for each firing period, but in continuous firing, all setting and drawing of ware is concentrated at strategic points for each operation and is thus ideal for mechanical and automatic means of transporting materials. This work can be done by unskilled labor or by women. The savings on this score amount to approximately 50 per cent on the average.

Still another saving is in saggers.



Open Fired Kiln for Fire Brick. Driers in the Foreground Receive Only Waste Heat



Small Ware Placed on Dressler Kiln Cars Ready for Firing

In continuous operation saggers are frequently not necessary, but when they are, their life is increased from three to five times over that in periodic operation. In tunnel kilns, the ware is placed on permanent refractory decks, which have an average service life of over 100 burns. This compares with the six to twenty burns possible with saggers under the old system. Seventy per cent saving seems to be a conservative average in connection with sagger cost.

Finally, there is the matter of upkeep. Repeated expansion and contraction, which attend the heating and cooling of the old type of kiln, result in frequent repair and replacement. Tunnel kilns have run uninterrupted for periods extending over more than five years. After such a time the repairs necessary are usually confined to the replacement of the combustion chambers in the furnace zone only. The main structure of a well constructed tunnel kiln should be good for 25 years or longer. Thus, on the average, savings and upkeep costs amount to fully 60 per cent when tunnel kilns replace the old periodic equipment.

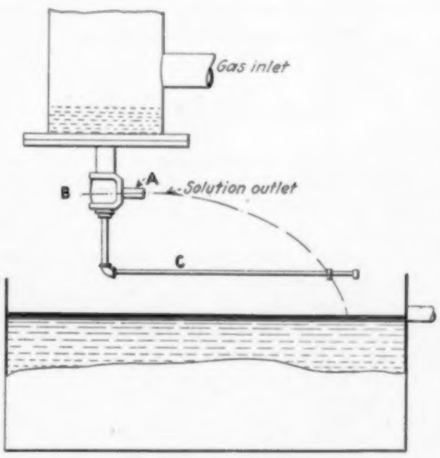
Watch Your Dampers

Certain types of dampers are capable of turning upon their shafts if forced and may do so when they have become old and rusted and have a tendency to stick in their ducts. As was emphasized by a recent accident where a core oven exploded on account of a damper that was closed (but should have been open) it must not be taken for granted that a damper handle in the proper position is final evidence of a correctly set damper. In the case mentioned the damper, being badly rusted, had stuck and turned upon its shaft, and made possible an explosion which tied up a department and occasioned a $5,000 loss.

Simple Liquid Flow Indicator

By Lloyd Logan
Baltimore, Md.

The frequent usefulness in the work of the writer of the flow indicator illustrated, the use of which has not previously come to his notice, is the only justification for calling attention to this simple and rather obvious device. This indicator, which is particularly useful in connection with the control of the rate of flow of liquids over experimental or other scrubbing towers, consists simply of a nipple *A* screwed horizontally into the outlet pipe *B* of the scrubber in such a manner that the parabolic stream of solution from the outlet of the scrubbing tower will impinge on the rod *C*. At the desired rate of flow of liquid, measured by means of a measured pail and a stop watch, the point at which the stream strikes the rod is marked in any convenient manner. Any deviation from this rate of flow is instantly visible. By the use of this method the inaccuracy due to undetected variations in the rate of flow and the inconvenience of periodic checking of the rate by means of a pail and stop watch may be avoided. Care should of course be taken to provide sufficient capacity between the bottom of the scrubber and the gas inlet pipe to prevent flooding of the latter at the maximum rate of flow.



Simple Means of Indicating Flow

Reduced Up-Keep Follows Use of Special Refractories

A recent Nielsen survey has pointed out an interesting comparison between two types of refractories used in boiler furnaces producing carbon dioxide for the Natural Carbonic Gas Company at Newark. Two hand-fired, coke-burning, Uniflow, return-tubular, 150-hp. boilers are used. These are normally in operation continuously for a period of about 8½ mos. per year.

The furnace temperature near the fire line averages about 2,800 deg. F. and may run as high as 3,100 deg. F. At this high temperature, the coke, which has an average ash content of slightly over 10 per cent, slags and builds out from the side and bridge walls for distances as great as 10 to 12 inches. Every 24 hours it becomes necessary to leave the furnace doors open long enough to cool the slag slightly so that it may be barred and hammered off the walls. In so doing, the refractory work of the setting necessarily receives a considerable amount of punishment.

Previous to 1922, constant trouble was experienced with the special mixture fire brick used at the fire line. It was ordinarily necessary to shut each boiler down for a period of about four days during the middle of the busy season when the boilers had been in service for four months, to repair the brick work at the fire line, where constant barring down of the slag had reduced its thickness until the refractories had dropped into the fire. Then again, at the end of the season, it was always necessary to rebuild the settings.

It was finally decided to try the use of Carborundum brick refractories, laid in a belt 18 in. high running around the side and bridge walls. This belt was installed in one boiler, and after a year the walls were found to be in a condition as good as when first installed. While the slag still formed and clung to the wall, its removal evidently did not harm the brick. As a result, the second boiler was treated similarly.

When the first boiler had been in service for 4½, and the second boiler for 3½ years, without repairs to these refractories, other conditions made it necessary to tear the boilers down. Hence, while it is still impossible to determine the actual service life of the present refractories, an estimate of five years is entirely safe. While their initial cost is very considerably higher than that of the fire brick, savings in labor and material necessitated in the frequent replacement of the latter by the use of the Carborundum material, gives it an advantage of about 61 per cent in cost reduction. Where the cost of the two refacings with fire brick, previously required annually, amounted to $177.68, the annual cost during the minimum expected life of the silicon carbide refractories amounts to only $68.78. This, of course, does not take into consideration the large, though difficultly evaluated item of time lost to manufacturing operations, during repairs under the old regime.

EQUIPMENT NEWS *from* MAKER *and* USER

New Wrought Iron Process

A new process for the manufacture of wrought iron, which is believed to have very attractive possibilities, is now being worked by the A. M. Byers Company of Pittsburgh. This process, known as the Byers New Process, was developed by Dr. James Ashton of the Carnegie Institute of Technology. Whereas former attempts to produce wrought iron more cheaply were generally patterned after the efforts of the hand puddler, substituting, however, mechanical means, the new process consists in impregnating the iron with slag by an operation known as "shotting." This is accomplished by pouring the molten iron into a bath of slag.

Pig iron is melted in a cupola after which it is refined in a converter. The metal from the converter is then poured into a bath of slag whereupon the metal is broken into pea-sized globules by the action of the gases which are liberated. Then the excess slag is poured off and the sponge of metal remaining, weighing approximately 2,200 lb, is dumped out and passed through a blooming mill. Subsequent operations are in accordance with previous practice.

The new process is said to be able to produce as much wrought iron in 20 minutes as can be turned out by two puddlers working a 10-hour day. At the same time, the quality of the iron is conceded to be as good if not better than the puddled product. The success of the process is such that the A. M. Byers Company is projecting a new plant to exploit the process, to be located at Ambridge, Pa.

The "Sponge" Is Dumped Out Ready for the Blooming Mill When the Excess Slag Has Been Poured Off

Ladle of "Bessemer" Being Poured Into the Slag Bath. This Is Known as "Shotting"

Automatic Backstop

For use on elevators, conveyors and process equipment drives where there is a likelihood of reversal of travel when equipment is standing idle, or when the motor has been shut off, the D. O. James Manufacturing Company, 1114 W. Monroe St., Chicago, has developed a flexible coupling and automatic backstop combination. The unit consists of a drum-shaped housing in which are three pawls engaging a ratchet. A flange integral with the reverse side of the housing forms half of a rubber-insulated, pin-type flexible coupling.

The backstop is installed between the motor and speed reducer. A flange which forms part of the ratchet is permanently attached to the speed reducer so that the case of the latter takes the load when the pawls engage the ratchet if the motor stops. During operation, however, centrifugal force keeps the pawls disengaged and noiseless.

Slide Rule Pencil

A logical combination of a pencil and slide rule has been developed by the Ruxton Multi-Vidor Corporation, 2445 Graybar Building, New York, N. Y. The pencil portion is of the usual automatic propelling and repelling type, while the slide rule portion consisting of Bakelite, is formed in two halves which slide with respect to each other and carry four scales, one pair of which is the inverse of the other. The scales are 4 in. long and accurately engraved to give an accuracy of reading comparable with the usual desk rule.

Jet Vacuum Pump

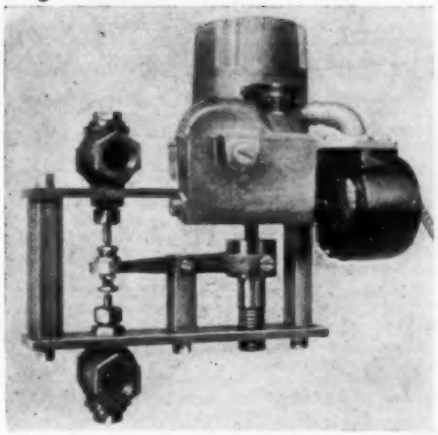
The Hydro-Steam air pump, shown in the accompanying illustration, is a two-stage vacuum pump built by Schutte & Koerting Company, Philadelphia, Pa. This pump is a development of a combination of the older multi-nozzle steam-jet and water-jet exhausters made by this company. The pump operates without inter or after condensers since the water jet itself functions as a condenser. That is, steam from the first jet, together with air or other non-condensable vapors extracted by the pump are mixed with the water from the water jet where the steam is condensed and the air is simultaneously discharged. This arrangement is said to be especially suited to the handling of corrosive vapors in the chemical plant.

The pumps are capable of producing vacuum in excess of 29 in. for normal operation. They are built in five standard sizes with suction connections varying between 2 and 6 in. As the water is only slightly heated in condensing the steam from the primary stage, it is said that it may be utilized for other condensing work at some other point in the process.

Cross-section of Hydro-Steam Air Pump

New Electric Crane

A new electric travelling crane, developed by the Box Crane & Hoist Corporation, Philadelphia, is made in sizes of one to three tons capacity and spans up to 50 feet. The crane requires headroom of less than 2 feet and may be installed in buildings with a minimum height of 10 feet.



St. Louis Motor-Operated Valves

Motor-Operated Temperature Control

Two valves, operated by a single motor, form a control which has been introduced by the St. Louis Motor Valve Company, St. Louis, Mo. One valve may be used for steam and the other for water. This system, combined with a contact-making thermometer of either the indicating or recording type, and a relay panel, permits heating or cooling, depending upon whether the system being controlled is too cold or too hot. The thermometer contains two contact points by means of which one circuit is made when the temperature is low and the other when the temperature is high. This rotates the motor in one direction or the other so as to rotate a screw and open one or the other of the valves through a lever mechanism. A limit switch stops the motor at the proper position.

New Water Supply Service

Fairbanks, Morse & Company has recently extended its activities through the formation of a new organization known as the Fairbanks, Morse Water Supply Company. The new organization undertakes to furnish a complete water supply service, guaranteed as to quantity and quality, at a definite price for any municipality or industry. The company surveys the water situation, finances and installs the equipment and operates the plant for a period of years, during which time the purchaser of the water has the option of taking over the plant. At the end of a fixed time, the payments for water have retired the capital charges and the title to the plant naturally passes to the purchaser. A number of installations have already been made.

Larger Texrope Drives

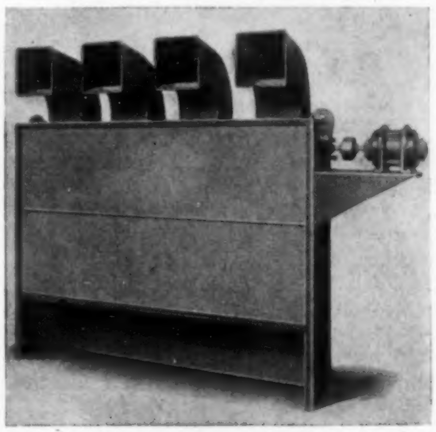
The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., announces that hereafter the stock of Texrope drives will include sizes up to 50 hp. for all popular motor speeds and ratios from 1:1 up to 7:1.

Valve Operating Unit

Automatic operation of all valves from 1 to 6 in. in size is possible through the use of the new Ao motor-driven valve-operating unit made by the Cutler-Hammer Manufacturing Company of Milwaukee. It consists of a small universal motor, controlled by limit switches and built-in reversing relays. The motor is combined with a gear train for operating the valve, driven through torque springs to provide a cushioning effect. The unit is readily attached to the valve in question and its mechanism may be instantly disengaged, by rotation of a lever, for hand operation of the valve. The manufacturers suggest that the unit is adapted to control valves either from push button stations or by means of float switches, temperature controlling devices or pressure regulators.

Industrial Heating Unit

The Sirocco unit heater is the newest of the products of the American Blower Company of Detroit. This unit is made in floor and ceiling types for low and high pressure service. It is of the design which employs several blowers mounted on a common shaft. The blower unit is readily removable for inspection

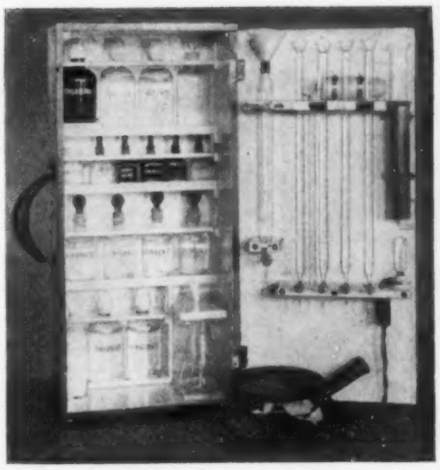


Floor Type Heating Unit

and for it very high efficiency is claimed. The heating unit may be either of the pipe coil or extended surface type. One feature of the heater is a mixing damper which is provided in case it is desired to supply outdoor air as part of the air feed to the heater.

Gasoline Locomotive Cranes

Link-Belt Company, Chicago, Ill., is now manufacturing a line of five sizes of locomotive cranes designed especially for operation with gasoline engines, Diesel engines or electric motors. These are known as the "L" type cranes. All are equipped with two-speed travel gear to take care of any circumstances encountered in moving the cranes.



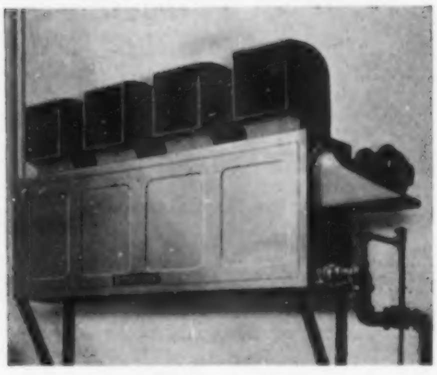
Babcock & Willcox "Lab-Rette" for Boiler and Feedwater Testing

"Lab-Rette" Water Testing Outfit

A recent article in *Chem. & Met.*, (Volume 35, No. 11, page 695) pointed out the necessity for the proper method of testing boiler feedwater. Similar considerations have prompted the Babcock & Wilcox Company of New York to develop a small portable laboratory which is called the "Lab-Rette." This outfit is very complete and when used in conjunction with the manual which accompanies it, makes possible the determination of (1) hardness, (2) chlorides, (3) sodium phosphate, (4) alkalinity, (5) pH value, (6) sodium sulphate, (7) dissolved oxygen and (8) total dissolved solids. The manual goes into such subjects as scale, corrosion, caustic embrittlement, foaming and priming and gives specifications and limits for dissolved solids in the boiler water as well as dissolved oxygen and solids in the feedwater. Special attention is given to the treatment of water with soda ash, sodium phosphate and sodium sulphate or their equivalent. The outfit has been so simplified that it may be used by any man of average intelligence.

Hardness and chlorides are determined by the usual method. Sodium phosphate is determined by a special method based upon the difference in action of mono-, di- and trisodium phosphate to phenolphthalein and methyl orange. The difference between the sum of the end points to phenolphthalein and methyl orange as determined by an alkalinity run of the sample and the end to phenolphthalein determined in a back titration using standard acid and alkali is a measure of sodium phosphate concentration.

Hydrogen-ion concentration is determined by colorimetric means. Sodium sulphate is determined by a specially constructed sulphate meter which makes use of the turbidity of a barium sulphate precipitate. Dissolved oxygen is determined by an improved Winkler method wherein the results are given directly in oxygen content. The total solids are approximated by the addition of certain of the foregoing factors.



"Highboy" Unit Heater

New Unit Heaters

The Buffalo Forge Company, Buffalo, N. Y., has recently developed a new line of unit heaters based on two standard designs. The one illustrated herewith, known as the "Highboy," is a tall model, while the "Lowboy" is approximately half the height. These heaters are adapted to floor or wall installation, or they may be suspended. Various types of outlets are available for the different forms of installation. The blower, of the multi-rotor type, may be driven by any desirable means and, if motor driven, the motor platform may be rotated to take care of any position of discharge. The rotors are easily removed through the end plate, as is the heater element. The latter consists of "Aerofin" tubing for steam pressure up to 150 lb. gage.

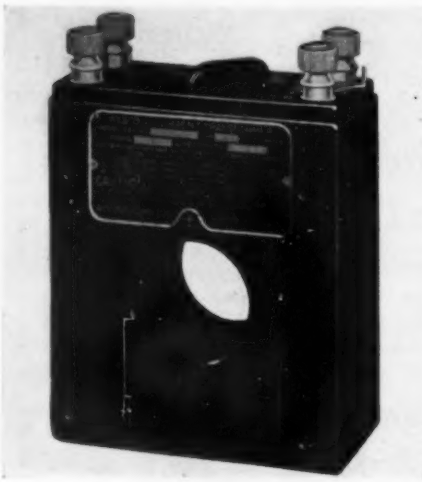
New Hard Lead Acid Valve

Hard Lead Valve

The Lined Products Division of the National Lead Company, New York, has recently announced a new hard lead flanged acid valve intended particularly for the rayon industry. It is known as the "Chem-Rayon" valve and is shown in the accompanying illustration. Features of the valve include a flanged construction which make the valve lighter while retaining strength. The bonnet is of steel and brass covered with hard lead. The stuffing box is extra deep. It will be noticed that the steel studs for tightening the gland have been attached to the yoke, instead of to the bonnet, to keep them out of the way of any acid which may leak through the gland. The valve may be supplied with a plug or a disk in hard lead or rubber.

Miniature Transformer

A recent development of the Weston Electrical Instrument Corporation of Newark, N. J., is the Model 539 Current Transformer. As the transformer has a one ampere secondary, it may be used with suitable instruments to obtain measurements of currents below one ampere. It has four self-contained primary ranges of 2, 5, 10 and 20 amperes, which are connected in by means of a switch. Ranges of 200, 100 and 50 amperes are also available by passing the conductor 1, 2, or 4 times through the hole in the transformer provided for that purpose. It is thus evident that when used with an ammeter of one ampere capacity, the range for the combination is from 0.2 to 200 amperes.



Wide-Range Miniature Transformer

Manufacturers' Latest Publications

Acid Recovery. National Lead Company, 111 Broadway, New York, N. Y.—Bulletin No. 4—describes the Simonson-Mantius vacuum process for sulphuric acid recovery in considerable detail.

Coke. Dry Quenching Equipment Corporation, 200 Madison Ave., New York, N. Y.—A reprint entitled "Dry Quenching of Coke," by D. W. Wilson.

Colloid Mills. Chemicolloid Laboratories, 44 Whitehall St., New York, N. Y.—Bulletin LB-3—describes the new laboratory Charlotte Colloid Mill.

Combustion Control. The Hays Corporation, Michigan City, Ind.—Publications as follows: Catalog AA-29, describing flue gas analyzers and portable combustion test sets; Catalog RA-29, describing automatic carbon dioxide, draft and flue gas temperature recorders.

Compressors. Pennsylvania Pump & Compressor Company, Easton, Pa.—Bulletin No. 144—describes the construction of single and double stage duplex air compressors for motor and belt drive.

Equipment. Angle Steel Stool Company, Plainwell, Mich.—General Catalog C-112 page catalog dealing with many kinds of steel equipment including trucks, racks, cans, stools, benches and desks.

Electrical Equipment. Crocker-Wheeler Electric Mfg. Company, Ampere, N. J.—Bulletin reviewing the developments, products and activities of this company.

Electrical Equipment. General Electric Company, Schenectady, N. Y.—Publications as follows: GEA-432A, D.C. generators and exciters; GEA-1075, temperature indicating equipment for A.C. generators and motors; GEA-1088, battery charging equipment.

Electrical Equipment. Monitor Controller Company, Baltimore, Md.—Bulletin No. 113—describes automatic A.C. starters.

Electrical Equipment. Roller-Smith Company, 233 Broadway, New York, N. Y.—Bulletin No. 580, Supplement No. 1—describes inclosed circuit breakers type EAF.

Gas Analysis. Charles Engelhard, Inc., Newark, N. J.—Bulletin describing the thermal conductivity method of gas analysis and apparatus for CO_2 and SO_2 analysis.

Gas Producers. Wellman-Seaver-Morgan Co., Cleveland, Ohio—Bulletin No. 91—describing the type "L" mechanical gas producer and giving engineering and economic data.

Gas Pumps. P.H. & F.M. Roots Company, Connersville, Ind.—Bulletin 33-B1—describes high pressure type rotary gas pumps for pressures of 10 lb. or less.

Material Handling. Chain Belt Company, Milwaukee, Wis.—Catalog No. 153—"Rex" foundry sand handling, conditioning system and mold conveyors.

Material Handling. Cleveland Crane & Engineering Company, Wickliffe, Ohio.—Form TR 634—describes the use of tramrails in ovens and dryers.

Material Handling. Stephens-Adamson Mfg. Company, Aurora, Ill.—New catalog describing skip hoists.

Metals and Alloys. American Manganese Steel Company, Chicago Heights, Ill.—Section 29 A—describes the improved Kranz beater bed plate of manganese steel.

Metals and Alloys. Central Alloy Steel Corporation, Massillon, Ohio—Form 46—a bulletin describing properties and uses of "Enduro" KA2 stainless steel made under the Krupp patents.

Metals and Alloys. The International Nickel Company, 67 Wall St., New York, N. Y.—Publications as follows: 1929 Buyers' Guide of Nickel Alloy Steel Products; Use of Nickel Alloy Steel in Curtiss Engines.

Metals and Alloys. The New Jersey Zinc Company, 160 Front St., New York, N. Y.—A booklet describing properties of zinc metals and alloys, uses, chemical analysis, physical and chemical properties. This booklet is punched to fit pocket size notebook.

Power Transmission. Gears and Forgings, Inc., Cleveland, Ohio—Publications as follows: Bulletin B, description and data on planetary speed reducers; Bulletin C, description and data regarding worm gear speed reducers.

Power Tranmission. Reeves Pulley Company, Columbus, Ind.—A booklet entitled "The Modern Need for Infinite Speed Adjustability." Goes into the use of Reeves drives in fifteen different industries.

Refrigeration. York Ice Machinery Corporation, York, Pa.—Bulletin No. 142—a reprint entitled "Recent Developments in Evaporating Systems," by Thomas Shipley.

Screens. Robins Conveying Belt Company, 15 Park Row, New York, N. Y.—Bulletin No. 73—completely descriptive of "Vibrex" screens.

Steam Generation. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.—A folder describing Kane gas-fired steam boilers for process steam.

Threaders. The Oster Manufacturing Company, Cleveland, Ohio—Folder describing a new pipe threading tool, the "Chip Chaser."

Unit Heaters. L. J. Wing Manufacturing Company, 154 West 14th St., New York, N. Y.—Complete data and information on "Featherweight" unit heaters.

Valves. Jenkins Bros., 80 White St., New York, N. Y.—A folder describing Jenkins Fire Underwriters valves.

Welding. Lincoln Electric Company, Cleveland, Ohio—American Welding Society paper by J. F. Lincoln, entitled "Suggested Designs for Arc-Welded Connections in Building Construction."

PATENTS ISSUED

Feb. 5, to Feb. 26, 1929

Glass, Paper and Pulp

Cooler for Sheet-Glass Apparatus. Horace E. Allen, Toledo, Ohio, assignor to The Libbey-Owens Sheet Glass Company, Toledo, Ohio.—1,701,170.

Glass-Working Machinery. Roy D. Mailey, East Orange, and Wilford J. Winninghoff, South Orange, N. J., assignors to Cooper Hewitt Electric Company, Hoboken, N. J.—1,701,758.

Process for Compounding and Vulcanizing Rubber and Products Obtained Therefrom. Sidney M. Cadwell, Leonia, N. J., assignor to The Naugatuck C hemical Company, Naugatuck, Conn.—1,701,946.

Attachment for Paper Machines. Eugene O'Brien, Eau Claire, Wis.—1,702,129.

Paper-Making Machine. Paul Priem, Heidenheim-on-the-Brenz, Germany, assignor to American Voith Contact Company, Inc., New York, N. Y.

Process and Apparatus for Reducing Pulp. Lloyd T. Murphy, Franklin, Ohio.—1,702,230.

Glass-Rolling Apparatus. John H. Fox, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company.—1,702,504.

Treatment of Residual Liquor. Linn Bradley, Montclair, N. J., and Edward P. McKeefe, Plattsburg, N. Y., assignors to Bradley-McKeefe Corporation, New York, N. Y.—1,702,586-9.

Process of Isolating Cellulose. Joseph Otis Peirce and Warren T. Reddish, Cincinnati, Ohio, assignors to The Twitchell Process Company, Cincinnati, Ohio.—1,703,-830.

Rubber, Rayon and Plastics

Paint and Varnish Liquid and Process of Making Same. Charles M. A. Stine, Cole Coolidge, and Edmund B. Middleton, Wilmington, Del., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,700,778-9.

Process for the Recovery of Ammonia from the Waste Waters in the Manufacture of Artificial Filaments by the Cuprammonia Process. Hugo Hofmann, Barmen, Germany, assignor, by mesne assignments, to American Bemberg Corporation.—1,701,110.

Hard-Rubber Coating Composition and Process of Making the Same. Samuel E. Sheppard and John J. Schmitt, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,701,129.

Process for the Manufacture of Cellulose Esters and Conversion Products Therefrom. Christian Ebert and Theadore Becker, Elberfeld, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,701,220.

Process of Conditioning Cellulose Fiber for Conversion into Cellulose Derivatives, and Product of Same. George A. Richter, Milton O. Schur, and Royal H. Rasch, Berlin, N. H., assignors to Brown Company, Berlin, N. H.—1,701,543.

Pyroxylin Composition. Robert Calvert, Wilmette, Ill., assignor to Van Schaak Bros. Chemical Works, Inc., Chicago, Ill.—1,702,151.

Pyroxylin Composition. Robert H. Van Schaack, Jr., Evanston, Ill., assignor to Van Schaack Bros. Chemical Works, Inc., Chicago, Ill.—1,702,180-1.

Process of Making Rubber Articles. William Burton Wescott, Boston, Mass., assignor to Rubber Latex Research Corporation, Boston, Mass.—1,102,225.

Manufacture of Rayon. Isaac B. Merriman, Providence, R. I., assignor to Manville Jenckes Company, Pawtucket, R. I.—1,702,-837.

Nitrocellulose Composition. Hamilton Bradshaw, Wilmington, Del.; Edgar H. Nollau, Newburgh, N. Y.; and Richard G. Woodbridge, Wilmington, Del., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,103,415.

Petroleum Refining and Products

Method of and Apparatus for Treating Oil and Its Constituents. Rudolph Conrader, Erie, Pa.—1,701,870.

System for the Production of Oil Gas. Frank T. Newitt, Platteville, and Simeon H. La Plant and Lewis I. Turner, Salida, Colo., assignors to The L. T. N. Manufacturing & Development System, Platteville, Colo.—1,701,892.

Process for Refining Mineral Oils. Alexander S. Ramage, Detroit, Mich., assignor, by mesne assignments, to Gyro Process Company.—1,702,313.

Treating Adsorbent Materials. Robert E. Manley, Port Arthur, Tex., assignor, by mesne assignments, to The Texas Company, New York, N. Y.—1,702,738.

Process of Preparing Hydrocarbons. Frank A. Howard, Elizabeth, N. J., assignor to Standard Oil Development Company.—1,702,899.

Process for Cracking Emulsified Petroleum Oil. Gustav Egloff and Harry B. Benner, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill.—1,703,103.

Art of Cracking Hydrocarbons. Eugene C. Herthel and Harry L. Pelzer, Chicago, Ill., assignors to Sinclair Refining Company, Chicago, Ill.—1,703,528-9.

Apparatus for Converting Hydrocarbons. Willis F. Sims, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,703,550.

Method of Refining Petroleum Oils. Otto Dieckmann, Cincinnati, Ohio.—1,703,615.

Desulphurization of Mineral Oils. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,-703,616.

Apparatus for Removing Carbonaceous Material From Oil-Treating Apparatus. Lyman C. Huff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,703,623.

Process of Obtaining Pure Mineral Oil Sulphonates. Charles Fischer, Jr., Wyoming, and Warren T. Reddish, Cincinnati, Ohio, assignors to The Twitchell Process Company, Cincinnati, Ohio.—1,703,838.

Coal Processing and Combustion

Gas-Purification Solution and Process. William H. Hill and David L. Jacobson, Pittsburgh, Pa., assignors to The Koppers Company, Pittsburgh, Pa.—1,700,982.

Method of Producing Water Gas. Charles W. Andrews, Duluth, Minn., and Herman A. Brassert, Chicago, Ill.—1,701,253.

Gas-Purification Process. Gilbert E. Seil, Newark, N. J., assignor to The Koppers Company, Pittsburgh, Pa.—1,701,825.

Purification of Coke-Oven Gases and the Like. Georges Claude, Paris, France, assignor, by mesne assignment, to Lazote, Inc.—1,702,683.

Vertical Coking Oven. Johann Lütz, Essen-Bredeney, Germany.—1,702,699.

Electrothermal Gas Producer. Willis S. Yard and Earl Newman, Percy, Oakland, Calif.—1,703,505-6.

Organic Processes

Apparatus for the Manufacture of Carbon. Anton Lederer, Vienna, Austria.—1,-700,942.

Method of Purifying Anthraquinone. Harry F. Lewis, Mount Vernon, Iowa, assignor to National Aniline & Chemical Company, Inc., New York, N. Y.—1,701,186.

Esters of Hexyl Alcohol. Hoylande Denune Young, Chicago, Ill., assignor to Van Schaack Bros., Chemical Works, Inc., Chicago, Ill.1,702,188.

Process of Manufacturing Sodium Xanthate. Wilhelm Hirschkind, Pittsburg, Calif., assignor to Great Western Electro-Chemical Company.—1,701,264.

Process of Producing Diacetone Alcohol. Carleton Ellis, Montclair, N. J., assignor to Ellis-Foster Company—1,701,473.

Manufacture of High-Grade Soaps From Low-Grade Fats. Joel Starrels, Chicago, Ill.—1,701,703.

Process for Producing Absolute Alcohol. Elwood I. Clapp, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.—1,702,495.

Process of Purifying Phthalic Anhydride. Alphons O. Jaeger and Frank A. Canon, Crafton, Pa., assignors to The Selden Company, Pittsburgh, Pa.—1,702,871.

Vegetable Glue and Process of Making Same. Lawrence Bradshaw and Henry V. Dunham, Bainbridge, N. Y.—1,702,133-4.

Inorganic Processes

Process for the Manufacture of Ammonium Nitrate in Water Solution and Simultaneous Concentration Thereof. Carlo Toniolo, Milan, Italy.—1,700,914.

Neutral Trisodium Phosphate. Charles F. Booth and Arthur B. Gerber, Anniston, Ala., assignors to Federal Phosphorus Company, Birmingham, Ala.—1,700,973.

Briquetted Charge and Process for Producing Phosphorus and Potash Therefrom. William H. Waggaman and Henry W. Easterwood, Chicago Heights, Ill., assignors to Victor Chemical Works, Chicago, Ill.—1,701,286.

Process of Obtaining Sodium Chloride. George B. Burnham, Reno, Nev., assignor to Burnham Chemical Company, Reno, Nev.—1,701,295.

Process of Recovering Cyanide From Solutions. Louis D. Mills and Thomas B. Crowe, Palo Alto, Calif., assignors to The Merrill Company, San Francisco, Calif.—1,701,818.

Light-Weight Ceramic Material and Process of Making the Same. Richard Ericson, Chicago, Ill., assignor to United States Gypsum Co., Chicago, Ill.—1,702,067.

Process for Producing Metal Chlorides Free From Water and Oxides. Max Jaeger, Wilhelm Moschel, and Robert Suchy, Bitterfeld, Germany, assignors to the Firm I. G. Farbenindustrie Aktiengesellschaft. Frankfort-on-the-Main, Germany—1,702,301.

Process for Producing Hydrocyanic Acid. Mortimer J. Brown, Niagara Falls, N. Y., assignor, by mesne assignments, to The Pacific R & H Chemical Corporation, Los Angeles, Calif.—1,702,761.

Desulphurization of Pyrite Cinders. Italo Cavalli, Padua, Italy.—1,703,027.

Recovery of Ammonia. Fred Osborne, Birmingham, Ala., assignor to Semet-Solvay Company, New York, N. Y.—1,703,405.

Chemical Engineering Processes and Equipment

Process of Protecting Pipe From Corrosion. Homer S. Burns and Lyman S. Bushnell, Freeport, Tex., assignors to Freeport Sulphur Company, Freeport, Tex.—1,700,995-6.

Apparatus for Continuously Treating Liquids. Alan E. Flowers, Poughkeepsie, N. Y., assignor to The De Laval Separator Company, New York, N. Y.—1,701,068.

Process for Dehydrating Oils, Fats, Etc. Charles V. Zoul, Santa Monica, Calif., assignor, by mesne assignment, to The Celite Company—1,701,092.

Art of Separating Liquids Having Different Boiling Points. Bates Torrey, Jr., and George R. Sanford, Syracuse, N. Y., assignors to Semet-Solvay Company, Solvay, N. Y.—1,701,988.

Process for Recovering Gases and Vapors from Gas Mixtures. Vitalis Pantenburg, Frankfort-on-the-Main, Germany.—1,702,311.

Coating Cast Iron with Lead. Oskar Spengler, Neubabelsberg-Bergstucken, near Berlin, Germany.—1,703,019.

Method of Treating Polluted Waste Water. John T. Travers, Columbus, Ohio, assignor, by direct and mesne assignments, to The Travers-Lewis Process Corporation, Columbus, Ohio.—1,703,373.

Filter - Cake - Discharging Apparatus. Jasper A. McCaskell, Salt Lake City, Utah.—1,700,772.

Apparatus for Centrifugal Separation. Charles E. Fawkes, Chicago, Ill.—1,700,928.

Zeolite. Alphons O. Jaeger and Johann A. Bertsch, St. Louis, Mo.; said Jaeger assignor to The Seldene Company, Pittsburgh, Pa.—1,701,075.

Water-Softening Apparatus. Walter J. Hughes, Fort Wayne, Ind., assignor, by mesne assignments, to The Permutit Company, New York, N. Y.—1,701,719.

Dehydrating Apparatus. Harold S. MacKaye, Yonkers, N. Y., assignor, by mesne assignments, to Dry Fresh Process, Inc.—1,701,813.

Furnace. Hiram B. Cannon, Sarnia, Ontario, Canada, assignor to The Carborundum Company, Niagara Falls, N. Y.—1,701,834-8.

Pulverizing Mill. Joe Crites, Evanston, Ill., assignor to The Raymond Brothers Impact Pulverizer Company, Chicago, Ill.—1,702,248.

Water-Softening Apparatus. Walter H. Green, Chicago, Ill., assignor, by mesne assignments, to General Zeolite Company, Chicago, Ill.—1,702,256-7.

Electrolytic Apparatus. William G. Allan, Toronto, Ontario, Canada, assignor, by mesne assignments, to Farley G. Clark.—1,702,924.

Centrifugal Separator. Tandy A. Bryson, Troy, N. Y., assignor, by mesne assignments, to Tolhurst Machine Works, Inc., Troy, N. Y.—1,703,094.

NEWS of the Industry

Ammonia Tariff is Subject of Sharp Controversy

RADICAL differences of opinion regarding tariff policy on ammonia and ammonia compounds have arisen which place the various chemical engineering groups of the country in two camps aligned against each other. Ammonia producers naturally would like to have the tariff retained on ammonium sulphate, but the fertilizer industry has joined the farm group in asking that this tariff be eliminated and that all other fertilizer constituents which contain only one plant food be retained on the free list. The fertilizer industry, however, has made a vigorous appeal for the imposition of a 25 per cent ad valorem duty on all chemical mixtures or compounds which contain two or more of the principal plant foods.

Opposition to this last request, which was made officially before the Ways and Means Committee by the National Fertilizer Association, has been expressed by importers. Dr. Sidney B. Haskell, vice-president of the Synthetic Nitrogen Products Corporation, of New York City, made a formal appearance requesting that Nitrophoska be imported duty-free. This concentrated fertilizer material, which contains all three plant foods, should be on the free list, according to this American representative of the German I.G., for the following four reasons: (1) That the requested tariff amounts to an embargo against Nitrophoska; (2) that increase in use of so concentrated a fertilizer as Nitrophoska will necessarily come slowly at best; (3) that the principal competitive advantage of Nitrophoska lies in its concentration which permits handling and transportation at a minimum cost per unit of plant food; and (4) that the desire to prohibit imports of such compounds is an obstacle to the progress of science.

Hearing on Increase in Duty for Barium Chloride

A PUBLIC hearing was held by the U. S. Tariff Commission on March 5, with reference to the application of the Grasselli Chemical Co. for an increase in import duty on barium chloride. Those who previously had opposed the application did not appear at the hearing and no testimony was introduced to support their contention. Zack Phelps of the Grasselli Company appeared in support of the application and answered questions propounded by members of the Commission. He expressed the opinion that foreign producers were not violating the anti-dumping law. He stated that the applicants were satisfied with the findings of the Commission and requested that they be made final. Production costs as compiled by the Commission indicated a difference of more than one and seven-eighths cents per lb. in favor of foreign producers.

Chemical Division of N.S.C. to Meet at Rochester

THE Chemical Division of the National Safety Council will hold a sectional meeting at Rochester, N. Y., April 17 and 18, and is expected to draw an attendance of between 300 and 500 members definitely interested in hazards of chemistry in industry.

The sessions will be held in the rooms of the Rochester Chamber of Commerce, probably the largest and finest equipped Chamber of Commerce plant anywhere in the country. Seneca Hotel will be the headquarters.

Dr. Leonard Greenberg, Yale Medical School, Yale University, is chairman of the program committee, and the local arrangements are in the hands of a large committee headed by A. L. Armstrong of Eastman Kodak Company, chairman of the Engineering committee, Chemical section, and member of the American Association of Safety Engineers. Co-operating at Rochester is the Industrial Safety group of the Industrial Management Council, Chamber of Commerce, A. E. Crockett, manager, and the Rochester Chapter, American Chemical Society, E. K. Carver, chairman.

The convention is to open at 9:30 o'clock Wednesday morning, April 17, and will continue without interruption until late that afternoon. There is to be a round-table luncheon that day for discussion of chemical hazards in industry with Harold Miner, of Du Ponts, as chairman. The following morning, Thursday, April 18, the delegates will make an inspection of the immense Kodak Park plant of the Eastman Kodak Company, leaving the Chamber of Commerce by bus at 9:30 o'clock. Arrangements can be made to visit any other plants which any delegates would like to inspect.

Potash Cartel Will Observe Sherman Law

A DECREE against the Deutsches Kalisyndikat Gesellschaft and the Societe Commerciale Des Potasses D'Alsace was today signed and entered in the District Court for the Southern District of New York. This decree was entered upon the consent of the foreign companies. It brings to a close litigation commenced on April 7, 1927, by the filing of a petition against members of the Franko Germany Potash cartel and their representatives who were in the United States for the purpose of establishing a single exclusive selling agency in this country. Defendants were charged with violation of the Sherman Act and the anti-trust provisions of the Wilson Tariff Act. Petition alleged in substance that the defendants by a combination and agreement in the United States, pursuant to contracts and arrangements entered into abroad, took steps to create and establish in this country a common selling agency. It was further alleged that prior to said combination and conspiracy, the defendants were engaged in interstate and foreign competition in the sale of potash salts through independent agencies located within the United States.

In May, 1927, the French defendants moved to dismiss the petition on the ground that the suit was in fact a suit against the French Republic, the owner of the French potash deposits in Alsace. A decision adverse to the contention of the French defendants was entered and filed on June 8, 1929.

Czechoslovak Dye Industry in Merger

ACCORDING to a report from our consul general at Prague, approval has been given by the Czechoslovak Government to the organization of the Czechoslovak Consolidated Dye Co., a joint stock company which will be formed by a merger of the Czechoslovak dye factories at Aussig, Braunau, Roechlitz, and Liberec, with the Joint Dye Works of Vienna. The shares of the Austrian company are now owned by the Dyeing and Printing Joint Stock Co. in Chur, Switzerland, with which are affiliated the Hungarian Textile Dyeing Co., Budapest, the Budapest Wool Manufacturing Co., and the Textile Printing Co., in Naefels.

Chemical Exposition To Demonstrate Results of Research Work

Many New Products and New Processes Will Be On Exhibition

PROGRESS made in the chemical engineering industries in recent years will be demonstrated at the Twelfth Exposition of the Chemical Industries which will be held at Grand Central Palace, New York, during the week beginning May 6.

Since the Eleventh Exposition of Chemical Industries in the Fall of 1927 many new processes have been developed with much new machinery and equipment for use in the chemical and allied industries. These new practices and processes have done much toward increasing the scope and markets both domestic and foreign for both raw and finished products along with the most advanced methods of handling. Hence the exposition will draw chemists, chemical engineers, manufacturers and others interested, from some forty industries which are dependent in their operations upon chemical changes in the material, or are under chemical control. Many new products as well as equipment will be shown for the first time.

These products include chemical engineering equipment and processes, special types of machinery as used by various industries which utilize the exposition to secure new equipment, and compare ideas and processes. The instruments of precision, laboratory apparatus, supplies and chemicals, raw materials used in the chemical industries, technical materials and chemical products which are applied to the arts and in the industries will be on display.

TWO features are to be the Southern and Canadian Sections. And there will be the educational course that plays such a prominent part in the exposition. The Student's Course of lectures by authorities in their own particular field of the chemical industries will draw students from most of the universities and technical schools. The work of the students is graded by Dr. W. T. Read, Professor of Chemistry from Texas Technological College, and a member of the advisory committee, who is in charge of the course.

These lectures are divided into two groups: one for elementary students where an extensive knowledge has not been gained, and the other an advanced course, for seniors and graduate students. Many colleges give credit for work done by students at the exposition.

Another division that is creating much interest is the Food Processing Equipment Section, which will contain many interesting exhibits. This division will contain much that is new to this field.

The exposition management is rapidly completing the various programs that will be effective during exposition week. The great Chemical Industries Banquet in which some fifteen to twenty organizations join will be held on Thursday evening of exposition week.

The interest that is being manifested at this early date indicates a greater number of exhibitors than ever before in the history of the exposition. One of the most important dates will be Export Day, May 9. On this day the exhibitors will be especially prepared to meet the foreign visitors and discuss with them their products in detail and the problems of the foreign representatives.

Infringement in Phthalic Anhydride Process

IN A SUIT brought by the Barrett Company of New York City against the Selden Company of Pittsburgh, Pa., involving the use of a patent covering an improvement in apparatus for promoting catalytic reactions, and notably in its application to the manufacture of phthalic anhydride, the U. S. Circuit Court for the Western District of Pennsylvania, has found for the plaintiff; that the plaintiff's patent is valid and infringed; and that a decree should be drawn in accordance with this finding.

On October 26, 1926, the patent involved was granted to Charles R. Downs, it covering a device to keep under control the temperatures of catalytic reactions, such as the creation of phthalic anhydride by the partial oxidation of naphthalene, in the presence of a catalyst.

Phthalic anhydride is produced by the catalytic vapor phase oxidation of naphthalene. It has been found in operation that during the oxidation necessary to the completion of the process very large amounts of heat are liberated, and, unless this heat is removed as soon as formed, the temperature rises rapidly to a destructive degree and the naphthalene is burned without the production of the phthalic anhydride.

Pine Institute Officers Continued in Office

THE 1929 meeting of the Pine Institute of America, which was held at Pensacola, Florida, last month, reelected officers for the ensuing year, as follows: president, A. F. Bullard, De Funiak Springs, Fla.; vice-president, H. H. Bruen, Savannah, Ga.; treasurer, H. W. Wilson, Jacksonville, Fla.; secretary, Carl F. Speh, Jacksonville, Fla. J. E. Lockwood of the Hercules Powder Co., of Wilmington, Del., was named as chairman of the 1930 get-together convention, which will be held at Jacksonville, Fla., during the third week of February next year.

The keynote address of the convention was delivered by Dr. Lewis H. Marks, executive secretary of the Industrial Alcohol Institute of New York and his text was: "Organization to develop markets for its products and research to develop products for its markets."

Resolutions were adopted to carry out Dr. Marks' suggestions when the naval stores industry and P.I.A. pledged co-operation to the United States Department of Commerce in research work which will seek to discover the various present uses of turpentine; to develop estimates of the volume consumed in each of these uses, and to make a complete study of the turpentine merchandising methods.

Dr. F. P. Veitch, bureau of chemistry, Washington, following an address which explained why residue was found in rosin and turpentine and told how it could be eliminated, stated that money for a year's work had been appropriated for a naval stores experiment station.

William N. Cohen Addresses New York Chemists

At the monthly meeting of the New York Chapter of the American Institute of Chemists held at the Chemists Club, New York City on March 8, the principal speaker was William N. Cohen, vice-president of the Association of the Bar of the City of New York and former Justice of the New York State Supreme Court. The Institute has taken exception to the distorted use of the word "chemist" and is seeking to establish the chemist as a professional entity so that the name will be as descriptive as that of physician, lawyer, etc. in their respective professions.

Mr. Cohen spoke on the legal aspects of the chemical profession. In the course of his talk he said "Chemistry is far-reaching in the confidence placed in its devotees and in its effects upon the community. It touches the homes, comforts and luxuries of life, and life itself. And as a source of wealth America's chemical output today outstrips that of any other country and reaches the enormous total of two billion two hundred and seventy-five million dollars. And yet, with all its far-reaching influences, with the enormous sum realized from its products there is in the State of New York and in most of the states of the Union no minimum fixed standard of character or education for the so-called chemist. It may well be asked: Is his calling today a job or a profession? It was natural, perhaps, in its early stages, a difficult question to answer but that should no longer be true today when not only the doctor and lawyer have standardized requisites before an individual can be called either, but chiropractors, osteopaths, nurses, midwives, plumbers, barbers and real estate agents—all must have licenses. Think of it! Anyone can designate himself and proclaim himself a chemist without let or hindrance from any authority whatever."

NEWS FROM WASHINGTON

By Paul Wooton

Washington Correspondent of Chem. & Met.

WORK of formulating the chemical schedule has begun. This task is in the hands of a sub-committee of the Committee on Ways and Means. Lindley H. Hadley, of Oregon, is the chairman of the chemical sub-committee, with Richard S. Aldrich, of Rhode Island, and James A. Frear, of Wisconsin, as the other members.

Mr. Hadley and Mr. Aldrich have sat through the seven and one-half weeks of the hearings before the full committee. Mr. Frear did not become a member of the committee until after the close of the hearings. He was appointed to fill the place made vacant by the death of Charles L. Faust, of Missouri. While Mr. Frear did not have the advantage of hearing the testimony before the committee, he is thoroughly familiar with the chemical schedule. While a Republican, Mr. Frear in the past has not been in full sympathy with the duties prescribed for many items on the chemical schedule.

The fact that the committee will spend only one month in the preparation of this bill is further evidence that the revision is to be confined to relatively few items. A much longer time would be required to formulate the bill were it necessary to adjust any large proportion of the paragraphs.

Nevertheless, it is understood to be the policy of the committee to give relief where the shoe pinches. There is reason to believe that very careful consideration will be given every paragraph in the chemical schedule where it has been established that definite and sincere competition has developed.

IT HAS been well established that a majority of the Ways and Means Committee is opposed to the imposition of duties on imports from the Philippine Islands. This bids fair to deflate the determined effort to secure high duties on animal and vegetable oils and fats. The users of industrial oils continue to urge that these imports be denatured. Evidence was presented to the committee showing that denatured oil has been brought into the country for more than twenty years with no known diversion of reworked oil into the edible field. Testimony also was presented showing that the Bureau of Animal Industry has been denaturing animal fats successfully for more than twenty-three years. There is a disinclination, however, to impose the denaturing requirement on the Philippines as the opinion of the majority is that it must be treated as though it were a state in the Union. It is very likely, however, that the denaturing required may be applied on oils from foreign countries.

There is every reason to believe that the duty on linseed oil will be increased so as to be compensatory with flaxseed. The prospects are that there will be no increase in the rate on soya bean oil. No cottonseed oil is imported. This applied also to oleo oil, oleo stearine and edible tallow. The duty on peanut oil already excludes practically all imports so that an increase will have little bearing on the situation. Corn oil is produced only in the United States. The chances are that China wood oil and perilla oil will stay on the free list. With the denaturing provision all of the non-drying industrial oils would be regarded as non-competitive. An increase on edible olive oil is unlikely as the present high rate of duty has not stimulated domestic production to a material extent. Since the chief uses of the industrial oils are in soaps, lubricants and greases, there is some opposition among farmers to duties which would increase the price of commodities of which they make such large use.

It is being charged that fish oil manufacturers are working with the farm organizations in the effort to secure high rates on vegetable oils. It is alleged that they would force paint makers, tanners and soap manufacturers to use more fish oil.

Practically half of the 1,100 witnesses who appeared before the committee apparently favored American valuation but a majority of the Ways and Means Committee is thought to be opposed to it and it is fully expected that the bill reported to the House will be on a basis of foreign valuation, with the exception of a few paragraphs.

BRIEFS filed before the Ways and Means Committee since the Chemical Schedule tariff hearings in January include the following:

Manufacturers of sulphate and hydrate of alumina for filtration and paper making request that bauxite ore, now dutiable at $1 per ton be placed on the free list. It is argued by the Kalbfleisch Corporation, the Merrimac Chemical Co., and Charles Lenning & Co. that bauxite reserves in this country are becoming depleted and that the encouragement of imports will promote conservation. Bauxite miners answer that their deposits are ample and want the duty raised rather than lowered.

The American Rutile Company wants ores containing 70 per cent or more of titanium dioxide assessed at 30 per cent ad valorem. This oxide, rutile, is used in electrodes, electric lights, ceramics, mordants, and for making titanium tetrachloride for naval smoke screens.

Opposition to any duty increase on decolorizing carbons is registered by Salomon & Brothers and by the Glidden Food Products Company. The American producers are in a good position, it is claimed, and higher protection would give them a monopoly, excluding German competition. No gas absorbing carbons are involved in the petitions so far received.

Objections to the proposed duty on dyestuffs were presented in a brief filed before the Ways and Means Committee by H. A. Metz, president of the General Dyestuff Corporation. The American industry is asking that the rate shall be changed from 45 per cent on American valuation to 60 per cent as during the emergency tariff.

The National Fertilizer Association requests that fertilizers containing two or more of the principal plant foods, namely, nitrogen, phosphoric acid, and potash, be removed from the free list and assessed at 20 per cent ad valorem. Importations from Germany are taking the cream of American market which is in these concentrated mixed fertilizers, according to Charles J. Brand, executive secretary of the Association. He states that the industry abroad has been an outgrowth of the War and has been encouraged by foreign governments in order to insure an emergency supply of nitrates.

Refuting these contentions, S. B. Haskell spoke for the Synthetic Nitrogen Products Corporation, American sales agency for the German I. G. Farbenindustrie. The proposed tariff is aimed at nitrophoska, a German 60 per cent plant food, he stated.

THE proposed tariff of 45 per cent on fats and oils was actively contested. Farming, dairy, and livestock interests are backing this increase toward price benefits to their byproducts. That the soap manufacturers, using a fifth of the oils and fats available in this country, are importing nearly half their raw materials duty free from tropical countries is the principal point of attack. Inasmuch as there is an annual surplus of 900,000,000 pounds of lard and since imports for the soap kettle amount to 700,000,000 lb., it is argued that a tariff would promote internal readjustments whereby the lard would stay within the United States and soap would go back to cottonseed and soy-bean oil thus making the nation self-sustaining in oils and fats.

Soap manufacturers would be principally affected. The bulk of the laundry soap industry was represented by F. M. Barnes who denied that the farmers could benefit from their proposal. There is an industrial shortage of at least a billion pounds of fats and oils per year, he stated, and vegetable oils are imported to fill this need at a low price whereas the exported lard is a relatively expensive commodity which could not find profitable markets in this country. Due to the shortage of industrial materials and partly to the trend toward white soap, the manufacturers have been forced to seek new sources of supply in the tropics while the farm products have gone into edible lines.

Basic Industries of Great Britain Show Improvement

Outlook for Chemical Production Favored By Conditions in Consuming Lines

From our London Correspondent

IN PUTTING pen to paper for the first time this year for this monthly contribution, one is more than ever impressed by the need to examine conditions in Great Britain somewhat through American spectacles, and the writer hopes that the pair which he purchased in the United States last year may be of assistance. The early promise of last year for British industry as a whole was not maintained, but the chemical industry was an exception, and after the confidence inherited from the previous year, it is more than probable that 1929 will register a material advance. A contributory factor is the fact that the public and also the financiers and industrialists are beginning to realize the value of chemistry and of chemical research, and even advertisements are now being drawn up in a pseudo-scientific manner. The rayon, fertilizer, coal and pharmaceutical industries have done much in this direction.

Thus the rayon supplement of the "Times" published a month ago has left its mark upon a very wide circle, but unfortunately there is still an almost total lack of appreciation that technical guidance for new companies based even in small measure upon technical processes, is to-day just as important as the scientific consideration of a balance sheet.

THE basic industries such as coal and steel are at last showing signs of recovery, the rock-bottom of prices having been definitely passed. Better business in the coal industry may still be dependant upon the successful organization of marketing boards, in order that the industry may talk with a united voice and thus come to an understanding with Germany, in order to prevent the enormous annual free gift of low coal prices made to neutrals. This situation can, however, only be remedied when Poland also can be brought into line, but just now both as regards production and prices, the tendency is definitely upward in this country. Considerable rationalization is taking place also in the coke industry, shipyards are busy, and with or without the help of American capital, there is prospect of the British steel industry again getting upon its feet. Geographically there is nothing to prevent the installation of an enormous steel plant on the American model, situated close to a British port, the cost of production at which would probably be less than in almost any other part of the world. If however, such a plant had to carry the dead weight of numerous other plants which are thereby scrapped, there is no gain on balance, and the solution is gradually being found in the writing off of dead capital and in the amalgamation of the more important companies. Naturally, both the fuel and the chemical industries have much to gain from all this, and a comprehensive scheme by which gas, as well as power, is distributed over the kingdom, is a possible ambition. The gas problem is, however, fundamentally different from that in Europe, and progress can therefore only be slow.

POSITION of Imperial Chemical Industries has continued to improve, particularly in the fertilizer field by the formation of a special Scottish company to handle their products in that market. Similar developments in other countries may follow. At Billingham, increased production has not quite kept pace with original expectations, but it has nevertheless remained creditably near them, and further extensions of plants are now about to be started up. The annual report of the Sulphate of Ammonia Federation indicates that at no distant date, the Billingham production will become the dominant factor, and the marketing organization of I.C.I., known as Nitram Ltd., is already more or less responsible for policy. The tendency will no doubt be to enter the field of compound fertilizers, in spite of the continued popularity of sulphate of ammonia. There seems to be no diminution in the enthusiasm for the future of the nitrogen industry, both in the ranks of the synthetic producers and among distributors of Chile nitrate. This is in marked contrast to the apparent pessimism of the "New World," and it remains to be seen whether the increase in production in Europe will overtake the increase of consumption sufficiently to cause any further material reduction in the world's nitrogen prices. New nitrogen plants in Europe are being built, using all the well-known systems, including that of the Nitrogen Engineering Corporation of New York. The second plant working under the Mont Cenis patents, at low temperatures and pressures has now been started up in Germany, and another plant is under construction in Holland. The latter is of particular interest, in view of the statements recently made that an understanding has been arrived at with the Shell-Royal Dutch group in connection with the Mont Cenis process, but as usual it is almost impossible to obtain accurate details, and the press reports are obviously somewhat garbled. In the low temperature carbonization field, the outstanding feature has been the decision of the two principal gas companies to install low temperature plants, and to place on the market the smokeless semi-coke resulting therefrom. The work of the Fuel Research Board has been of considerable importance in this connection, and in particular the results obtained from their experiments on the hydrogenation of coal have been particularly valuable in instructing public and industrial opinion in regard to the possibilities. It is clear that a modified Bergius process is applicable to British and to certain Colonial coals, but it is too early to say whether commercial success is in sight, and evidently the very high hopes of the I.G. have not yet been realized, either as regards production of gasoline, or as regards a resulting reduction in the cost of hydrogen for nitrogen fertilizers. Arising out of this work, English Patent No. 301,720, granted to members of the Fuel Research Board is of more than usual interest, disclosing as it does that anthracite, lignite and other carbonaceous material, when subjected to only a partial hydrogenation of the material, can be converted at will into a solid product which, when carbonized, yields a hard swollen or non-swollen coke; in fact, by modifying the treatment, any desired coking qualities may be imparted to the initial material, and by carrying the process a stage further a pitch, suitable as a binder for briquetting, may also be obtained.

THE resignation of Dr. E. F. Armstrong, from the position of Managing Director of the British Dyestuffs Corporation, did not come altogether as a surprise, and his outstanding abilities and his versatility are now finding employment in other direction, such as that of a seat on the board of directors of the South Metropolitan Gas Company. Lord Birkenhead has joined the Board of Imperial Chemical Industries, and is ever becoming a more contraversial figure in industrialized politics. To speak of the Nickel merger would be conveying stale news, and if one may venture on prophecy, the next tool of I.C.I. to be brought into use is likely to be the British-American Finance Company, which was brought into being a year ago. It seems pretty clear that the British I.G. is now large enough for all practical purposes, and in its new building and in the perfecting of its organization, there is enough work to keep even their energetic directors fully employed for some months.

Sulphur Deposit in Mexico Under Development

IN A report from Mexicali, Mexico, to the Department of Commerce, it is stated that Colonel Esteban Canter of Mexicali, former governor of this district, has for some time been engaged in the proposed development of some rather important, high percentage sulphur deposits which are said to exist below San Felipe near the coast on the west shore of the Gulf of California where direct shipment by boat is feasible. No sulphur has been reported as shipped.

Tendency Toward Amalgamations in French Chemical Industry

Central Sales Agencies Established for Dyes and Carbon Bisulphide

From our Paris Correspondent

EXPANSION of the chemical industry in France has given rise to a tendency toward amalgamations. In 1928 the following firms united: the Société Chimique des Usines du Rhône with the Etablissements Poulenc Frères, the Société du Celluloide with the Société Petit-Collin and the Société l'Oyonnithe, the Société pour la fabrication de la Dynamite and the Société des Matières Plastiques. As a result of amalgamations, dye producers have established a central sales agency, which will probably take the place of the Consumers and Producers Union, which has for ten years controlled all dye imports into France, both for the German payments in kind and other foreign imports needing an import license. The Union was however a governmental office created by the situation arising from the treaty of Versailles, whereas the new central office is a strictly private concern.

A central office has been established for the sale of carbon bisulphide by the Progil-Kuhlmann Co. and other firms besides the Deiss Co., up to now the most important manufacturer of this chemical product. The demand for carbon bisulphide is increasing owing to the growing needs of the rayon industry. On the other hand the partaking of existing firms in new societies and the constant increase of working capital shows that the situation is satisfactory both from the technical and the commercial point of view.

The Société Alsacienne de Produits Chimiques, has already increased its capital to 85 million French francs and will increase it to 100 million. One of the firms's objectives is the development of the manufacture of synthetic camphor by the Vaugoin works, one of the company's factories, whose present daily output of 2½ tons is to be doubled. Synthetic camphor is made by the action of acetic anhydride on turpentine, yielding borneol acetate which, when treated, gives camphor, which does not contain chlorine and therefore never turns yellow. On the contrary camphor made by the pinene hydro-chloride process always turns yellow. This same company controls tartric acid works in Languedoc in Southwestern France. These works are to be developed until they can produce a yearly output of 1000 tons. A second tartric acid factory is to be built at La Rochelle in order to obtain a yearly output of 2500 tons of tartric acid. A German factory recently started to produce adipic acid by oxydation of cyclohexanol; this acid may become a competitor of tartric acid in the manufacturing of baking powders.

The St. Gobain Co., the oldest chemical firm of France, which was founded under Louis the XIVth's reign, three centuries ago, has increased its capital from 161 to 205 million French francs. A further increase is being contemplated for the issuing of plural vote shares. There is a general tendency in the French industry to issue plural vote shares in order to prevent the home industries from going into foreign hands, as French shares whose worth is likely to increase are now sought by foreign investors. As an example we can quote the I. G. Farbenindustrie A. G., which is said to buy all the Kuhlmann shares on the market. By the issuing of plural vote shares the control of the business remains in the hands of the French trustees.

SPEAKING of the Kuhlmann Co. we may mention that their capital is being raised from 250 to 300 million French frances. Besides the participations held in several companies this Kuhlmann Co. is one of the main shareholders of a new Belgian business at Liège, with a working capital of 60 million, for the manufacturing of synthetic ammonia in Belgium.

We have already referred to the formation of a new company: the Textiles Chimiques du Nord et de l'Est supported by the Kuhlmann group. The Textiles Chimiques du Nord et de l'Est, the Société Rhodiaseta and the St. Gobain Co. have formed a new company whose objective is the manufacture of acetate silk, the Société Rhodiaseta bringing as assets its manufacturing processes and 3 million French francs being 50 per cent of the working capital, the other 50 per cent being brought by the Textile Chimiques du Nord et de l'Est 30 per cent and the St. Gobain Co. 20 per cent.

This is the first time that the St. Gobain group has invested money in the rayon industry. The Bozel-Maletra group had already formed a new company for the manufacturing of acetate silk by the Soie de Chatillon process. As may be gathered by the above the manufacture of acetate silk increases steadily. The fall of prices started by the "Celanese" clearly shows that commercial warfare has started between the several producers. Legal proceedings concerning the right to hold the patent processes also have begun.

IT IS interesting to note that while the French output of rayon reaches 10,000 tons, the consumption of natural silk is about 7200 tons of which 95 per cent must be imported. At present France produces 3,655,600 kg. of cocoons, worth 75 million French francs, and corresponding to 300,000 kg. of silk whereas three quarters of a century ago France's output was 28 million kg. of cocoons. The rising price of labor in France is against the raising of silk worms and the making of cocoons is now being developed in the French colonies, especially Indo-China. The weight of real silk is doubled by silk weighting with silico-phosphate of tin which is made by dipping silk in a tin tetrachloride bath.

"Aviation" Added to List of McGraw-Hill Papers

AVIATION, the oldest American aeronautical magazine, has been purchased by the McGraw-Hill Publishing Company, and it thus joins the group of 25 engineering, industrial, and business papers, of which *Chem. & Met.* is a member. This weekly journal, founded twelve years ago by Major Lester D. Gardner, serves the broad field covered by the rapidly growing aircraft industry, which, in all of its aspects, accounts for an annual expenditure of $100,000,000.

Aviation bears a peculiar and important relation to the chemical engineering industries. New light-weight alloys and other constructional materials, paint, and other surface and wing finishes, efficient lubricants, and special motor fuels are some of the chemical engineering products that go into the modern plane. But industrial executives in the chemical engineering field were also among the first to accept the airplane as an important transportation medium, and, therefore, a valuable tool of business. The petroleum industry, for example, has found air transportation the logical link between distant oil fields and refining centers. Other related industries have followed this example.

It was the basic character of the aircraft industry and the assured future of aeronautics that led the McGraw-Hill company to buy *Aviation*, according to a statement made by James H. McGraw, chairman of the board. "In 1928," declared Mr. McGraw, "there were sixty-six nationally known business houses using one or more planes in their normal, every-day business operations. The list is growing. There are today over 175 aircraft manufacturers in the United States who are either producing or preparing to go into the production of planes. Production in 1927 was valued at $9,000,000. Last year, it had increased to $20,000,000. Forecasts generally considered as reasonable indicate that from 6,000 to 10,000 new planes will be built in 1929.

"In purchasing *Aviation*," Mr. McGraw continues, "our aim is to expand and intensify the splendid service which this pioneer paper has already been rendering to its industry by bringing to its support the greater resources of the McGraw-Hill organization. We enter this new field only because it is clear that there is an opportunity to render a service that will advance the art of flying and its economic development."

News in Brief

THE PRESIDENT on Feb. 20 signed the act of Congress authorizing an appropriation of $150,000 for research work looking to the discovery of improved methods of recovering potash. The authorization is intended to take care of a three-year program to be carried on by the Bureau of Mines and the Bureau of Soils.

AT THE RECENT MEETING of the United States Shellac Importers Association, the following officers were elected for the ensuing year: H. S. Chatfield, president; L. J. Calvocoressi, vice-president; L. W. Babbidge, secretary-treasurer. Directors are William Zinsser, A. F. Lerden, Morris Rosen, R. W. McClintock, and Guy Carleton.

THE SHELL UNION AND ROYAL DUTCH petroleum combine has formed a large subsidiary which will commercialize and manufacture on an extensive scale new chemical products and processes perfected and developed by the Shell Development Company.

TO ASSIST IN THE CONDUCT of engineering research, the University of Illinois maintains fourteen Research Graduate Assistantships in the Engineering Experiment Station. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry.

"THE CHEMISTRY OF BITUMINOUS HIGHWAY CONSTRUCTION" was the subject of the papers presented before the Society of Chemical Industry at the February meeting in New York City. Prevost Hubbard, secretary of the Asphalt Association, presented a paper on "Petroleum Asphalt," John Strother Miller, chief chemist, Barber Asphalt Co., "Native Asphalt"; Sumner Church, consultant, "Tar" and Edgar S. Ross, Hedley Good Roads Co. "Asphalt Emulsions."

THE FEDERAL COURT OF NEW JERSEY has ordered that the properties and assets of the Cook, Swan & Young Corporation be sold to Gilbert P. Smith and J. Howard Smith. The receivers of the company are directed to sell all the assets, consisting of the oil refining plant at Bayway, N. J., and a long list of inventories, principally crude and refined fish oils, but not to pass title to the assets until April 15. In the meanwhile, the court or the receivers will receive bids in excess of the one made by the Smiths, and in the event such bids are received, the court will withhold designation of the successful buyer until April 19.

REPORTS TO THE DEPARTMENT OF COMMERCE state that among the byproducts which help to sustain the electrolytic caustic soda producers of Italy with an outlet for some of the excess chlorine is a compound of copper oxychloride successfully marketed by the Elettrochimica del Caffaro under the trade name Pasta Caffaro. This compound is widely used to combat diseases of the grape vine.

THE NAME HARSHAW FULLER & GOODWIN CO. has been changed to the Harshaw Chemical Co. Main offices are in Cleveland. The company organized in 1892 as the Cleveland Commercial Co., was reorganized in 1898 as the Harshaw Fuller & Goodwin Co., with home offices in Elyria. J. A. McGean has retired as president and has been succeeded by W. A. Harshaw.

Dr. Lewis Gives Addresses in Virginia

AN ADDRESS was delivered on March 8 by Dr. Warren K. Lewis, head of the Department of Chemical Engineering at the Massachusetts Institute of Technology, at the University of Virginia before the Schools of Chemistry and Chemical Engineering. He dealt with modern problems encountered in the oil industry, with particular reference to cracking and the disposal of cracked residues. After enumerating a number of the factors arising from physico-chemical considerations upon which any analysis of cracking operations must be based, he pointed out the complications into which the several phenomena led, often opposing in their tendencies. Admitting that a really quantitative interpretation of cracking satisfactory to the physical chemist was difficult due to the complicated mixtures encountered, he emphasized the usefulness of many generalizations which could be made involving pressure, temperature, and reaction kinetics.

He concluded with a stirring appeal for the chemical engineer in the oil industry, where the demands of the chemist on the one hand, he said, could only be reconciled with the maximum possibilities of mechanical construction on the other by an individual properly trained in both fields. The address was enthusiastically received by a large audience.

Earlier in the day Dr. Lewis talked before the Richmond Chamber of Commerce at a luncheon meeting, where he emphasized the need for trained engineers in such a rapidly growing industrial community as Virginia with its enormous potential resources. In the afternoon he spoke at the University of Richmond along similar lines.

On March 9 he was the principal speaker at the annual joint meeting of the Virginia Section, A.C.S., and the Hampton Roads Chemists' Club at the Chamberlin-Vanderbilt Hotel at Old Point Comfort.

McGraw-Hill Editors Visit the South

RAPID growth of the new industrial South was responsible for the decision of a group of executives and editors of the McGraw-Hill Publishing Company, publisher of engineering, industrial and business papers, to visit important southern manufacturing centers in the first two weeks of March. The visiting editors represent a group of publications which are intimately in touch with southern business expansion and which maintain regular correspondents in southern cities.

The full sweep of industry in the South will be studied by the seventeen men who make up the party. Plants devoted to textiles, chemicals, steam and electric power generation, naval stores and other basic products will be included in the list of developments to be seen. Chambers of Commerce and individual industrial leaders at points included in the itinerary will co-operate in the plan to enable the visiting editors to gain a first-hand view of southern industrial activity.

Chemical executives of the Charleston, W. Va. district gave a complimentary dinner to the editors who visited that city on March 4. W. E. Callahan, manager of the Sharples Solvents Corporation, presided and brief talks were made by Edward J. Mehren, editor of the *Magazine of Business;* Sidney D. Kirkpatrick, editor of *Chem. & Met.;* B. H. Jacobson, manager of E. C. Klipstein Sons Company and S. P. Puffer, managing director of the Charleston Chamber of Commerce.

Present at the dinner in addition to the twelve members of the McGraw-Hill party were the following executives: Carl N. Hand, president, Rubber Service Laboratories, Inc.; W. B. Vivian, manager, Viscose Co.; Dr. C. W. Norris, manager, Seydel Chemical Co.; C. L. Voress, secretary, Viking Laboratories, Inc.; C. H. Doherty, manager, Lazote, Inc.; D. W. Stubblefield, manager, Belle Alkali Co.; M. G. Geiger, manager, Westvaco Chlorine Products Co.; J. J. Riley, president, Barium Reduction Co.; B. H. Jacobson, manager, E. C. Klipstein Sons Co.; J. W. McLaughlin, Works Manager, Carbide & Carbon Chemicals Corp.; Fred Hanlin, president, West Virginia Manufacturers Association; J. N. Compton, Carbide & Carbon Chemicals Corp.

Paint and Varnish Census on Monthly Basis

After different meetings between representatives of the paint and varnish industry and members of The Census Bureau, it has been decided to revise the census for that industry. Heretofore it has been customary to issue figures for production semi-annually. The census will now be placed on a monthly basis but will not go into the detail observed in the previous method of compiling statistics.

MEN in Chemical Engineering

CARL BOSCH, W. GANS and JULIUS BUEB were among the representatives of the German chemical industry that sailed from Hamburg on the *Deutschland* on March 8 for a visit to this country. They are due to arrive in New York about the 18th.

H. HOBART PORTER is the new successor to L. B. Stillwell as chairman of the Engineering Foundation. His election follows two long periods of service on the board of this organization, his original connection tracing to 1918. Mr. Porter is president of the American Water Works & Electric Company, and holds directorships in numerous other firms.

LAWRENCE W. BASS, formerly an associate in the chemistry division of the Rockefeller Institute, has accepted appointment as executive assistant at the Mellon Institute of Industrial Research.

W. K. LEWIS, head of the department of chemical engineering at Massachusetts Institute of Technology, addressed a joint meeting of the Hampton Roads Chemists' Club and the Virginia Section of the A.C.S., held at the Chamberlain-Vanderbilt Hotel at Old Point Comfort, March 9.

LAUREN B. HITCHCOCK, who is now in charge of chemical engineering at the University of Virginia, accompanied the McGraw-Hill editors in the inspection of important chemical engineering industries in the Richmond-Hopewell district on March 5.

CHESTER H. PENNING, who was technical editor for the Chemical Catalog Company, New York, has joined the Federal Phosphorus Company at Birmingham, Ala., to engage in commercial research beginning April 1.

EDWARD WESTON, eminent leader in electrochemistry and industrial instrumentation for many years, has established a fellowship under his name with the American Electrochemical Society. It will be awarded to a candidate selected by the Society who has shown marked capacity for electrochemical research. The first award will probably be made later in this year.

HOWARD E. BATSFORD, who was designing engineer in the research department of the Rome Wire Company, has accepted a position as development engineer for the American La France & Foamite Corporation.

ROBERT T. HENDRICK has joined the ceramic materials division of the Titanium Alloy Manufacturing Company, coming from a position with the Commercial Solvents Corporation.

HERBERT H. DOW, president of the Dow Chemical Company, was the guest of honor at the annual dinner of the Chemists' Club, held in New York, February 27. Several chemists and industrialists were present to hear Dr. Charles L. Reese, director of the duPont Company, discuss the chemical engineering achievements of the guest. "Herbert H. Dow, Industrialist," was the subject of a subsequent talk by Edwin M. Allen, president of the Mathieson Alkali Works and James T. Pardee, who has been associated with Mr. Dow for forty-five years, gave an intimate account of the life and human interests of the guest. Dr. Dow responded to the good wishes of his friends with an interesting account of the experiences that led to the establishment and growth of the great institution at Midland which bears his name.

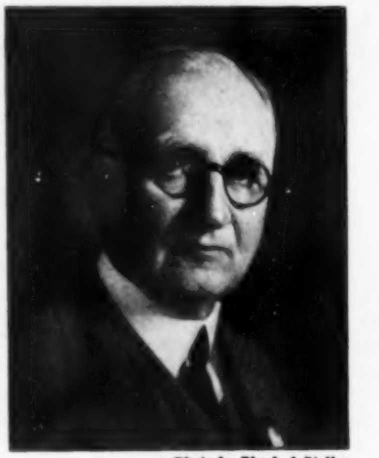


Photo by Blank & Stoller
HERBERT H. DOW

THOMAS S. COOK was elected a director of the Standard Oil Company of Indiana at its recent meeting. As one of the company's refinery experts he was lent to the subsidiary Pan-American Petroleum and Transport Company as general manager of manufacture.

WILLIAM RUSSELL, managing director of the Dorr organization in Great Britain, Germany and France, arrived in New York on February 26 on the *Aquitania* for a short visit here.

H. C. PARMELEE, editorial director of the McGraw-Hill Publishing Company, headed the group of seventeen executives and editors who have just completed a two-weeks tour of industrial centers of the Southeast. The editorial party, which included Sidney D. Kirkpatrick, editor of *Chem. & Met.*, visited Charleston, W. Va., Richmond and Hopewell, Va., Greensboro, Winston-Salem and Charlotte, N. C., Greenville, S. C., Savannah and Atlanta, Ga., Birmingham, Ala., and Chattanooga, Johnson City and Kingsport, Tenn.

M. G. GEIGER has succeeded A. M. Pitcher as manager of the plant of the Westvaco Chlorine Products, Inc., at South Charleston, W. Va. Mr. Pitcher has been transferred to the executive offices of the company in New York.

EDWARD E. MARBAKER has left the Mellon Institute at Pittsburgh to pursue private interests, included in which is the formation of a new research organization.

WILLIAM M. BURTON, former president of the Standard Oil Company of Indiana until his retiring in 1926, has been elected to the directorate of that company. Dr. Burton is perhaps best known to chemical engineers for his contributions to cracking technology.

R. R. WILLIAMS, director of chemical research for the Bell Telephone Laboratories, is now on the way to recovery from a severe attack of pneumonia which incapacitated him for over a month.

ROLAND WARD, who graduated from two British colleges and has gained industrial experience here and abroad, is the recipient of the Jeavons fellowship in chemistry at Western Reserve University.

FRANKLIN STOCKTON, formerly of the Mellon Institute of Industrial Research, has joined the research laboratory of the Sheet and Tin Plate Company at Pittsburgh.

C. M. TAYLOR, a vice-president of the Lincoln Electric Company, has assumed the duties of sales manager in place of those of factory manager which he has fulfilled since 1923.

CALENDAR OF FORTHCOMING EVENTS

AMERICAN CHEMICAL SOCIETY, 77th meeting, Columbus, Ohio, April 29-May 3, 1929.

AMERICAN ELECTROCHEMICAL SOCIETY, spring meeting, Toronto, May 27-29, 1929.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, mid-year meeting, Philadelphia, June 19-21; June 22, conference on chemical engineering education.

AMERICAN INSTITUTE OF CHEMISTS, annual meeting, New York, May 4.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, June 24-28.

SEVENTH COLLOID SYMPOSIUM, Baltimore, Md., June 20-22.

TWELFTH EXPOSITION OF CHEMICAL INDUSTRIES, Grand Central Palace, New York, May 6-11, 1929.

Gentry S. Cash, manager of the principal refinery of the Standard Oil Company of Indiana, has been elected a director of that company.

Arthur W. Allen, editor of *Engineering and Mining Journal,* and formerly assistant editor of *Chem. & Met.,* sailed on March 2 for England and the Continent. He expects to spend about seven weeks abroad in the study of present conditions.

F. Rothe, director of the Kali Chemie Aktiengesellschaft, Berlin, has been making a tour of the Western states where he has observed American methods in metallurgical and chemical operations.

J. R. Shea has received appointment as assistant engineer for manufacturing development at the Kearny, N. J., and Point Breeze, Md., plants of the Western Electric Company. He was transferred from the plant at Hawthorne, Ill.

R. D. Jessup has been made assistant superintendent of the assembly and inspection divisions of the Western Electric Company at its Hawthorne, Ill., plant.

Francis McDonald, who has been director of research of the American Potash & Chemical Company at Trona, Calif., has resigned to do work in engineering research and development for the engineering department of E. I. du Pont de Nemours Company at Wilmington, Del. He had been in charge of the research work at Trona for a year and a half and had previously acted as assistant director for four years.

OBITUARY

T. F. Merseles, president for the past two years of Johns-Manville, Inc., died of heart disease in Del Monte, Calif., on March 6 at the age of 65. Mr. Merseles had a varied and successful career as an organizer, several national concerns having benefited by his leadership in troubled periods.

Albert Hill, director, vice president and treasurer of the Atlantic Refining Company, Philadelphia, died on March 10 in his 59th year, following an illness of six months. He had been in the employ of this company for 40 years following his graduation from the University of Pennsylvania.

Benjamin A. Hegemann, president of the Anglo-American Varnish Company, Newark, N. J., died on March 6 in New York at the age of 68 after an illness of several weeks.

Edward B. Williams, chief engineer of the Continental Oil Company, Denver, Col., died suddenly on March 3. He was 54 years old and had been with his company for eight years.

Arline Ruth Smith, young daughter of Dr. Julian F. and Irene F. Smith, technical librarians of Akron, Ohio, died suddenly on February 24 of a heart collapse due to an attack of pneumonia, from which she appeared to be recovering.

Robert E. Zink, chief engineer of the Hercules Powder Company, fell victim to an attack of pneumonia on February 14 at his home in Wilmington, Del.

Mr. Zink had not quite completed his 42nd year at the time of his death. He was a native of Bridgeport, Conn., where he also received his early education. In 1911 he had completed an engineering training at Cornell University, thereupon entering the employ of the Fletcher Engineering Company in Alberta, Canada, for whom he designed several projects. Upon returning to this country in 1915 he was engaged in

ROBERT E. ZINK

chemical construction work until 1917, when he was commissioned as captain in the U. S. Artillery service.

Mr. Zink's connection with the Hercules Powder Company dated to 1920; at that time he joined the engineering staff and late in 1928 he was made chief engineer.

Robert P. Noble, fellow of the American Institute of Chemistry and associated with the Drexel Institute, died in Philadelphia on February 22.

Asa Griggs Candler, one of that earlier group of Americans who individually created industries of national proportions, died on March 12 in Atlanta, Ga., at the age of 77. The Coca Cola Company, which he acquired as a small concern in 1891, was the object of his entire care and in its beginnings at that time Mr. Candler personally worked at his product in a small factory-shed; the success of this enterprise later became phenomenal.

Marion E. Sparks, author of "Chemical Literature and Its Uses" and librarian of the Chemical Department of the University of Illinois died suddenly February 10. For many years Miss Sparks had faithfully served as the unofficial alumni secretary of the department and in this capacity was intimately acquainted with more of the chemical graduates than any other individual. Graduating with a B.A. degree from the University of Illinois in 1895, her connection with chemical literature, in which she became an eminent authority, dated from a position as resident bibliographer in the nutrition investigation laboratory.

Matthew Griswold, retired manager of the General Electric Company's Erie Works, died in Erie, Pa., on February 10. Mr. Griswold was born in 1866 and graduated in engineering from Yale University in 1888. Later he joined the Griswold Manufacturing Co., becoming its president for several years. In 1912 he became plant manager for the General Electric Company at Erie, and remained in active duty there until this year.

INDUSTRIAL NOTES

The Armstrong Cork Company announces the consolidation of the offices of all its divisions at Lancaster, Pennsylvania, effective April 1, 1929. This involves the removal from Pittsburgh of the general and all executive offices, with the exception of the purchasing department, which will remain in Pittsburgh.

The Homestead Valve Company, Homestead, Pa., announces that its Eastern sales manager, H. P. Ackerman, is now established at 908 W. Trade St., Charlotte, N. C., as its agent.

Craftex Company, Boston, Mass., has disposed of a major financial interest to the Bemis Industries, Inc., although this involves no change in personnel or polices.

The Link-Belt Company has elected James S. Watson, who is head of the drive chain division, a vice-president of the company.

The H. K. Ferguson Company has added F. L. A. Schmidt to its power plant engineering staff at Cleveland, Ohio.

Quigley Furnace Specialties Company, New York, has made M. F. Behar advertising manager, to specialize in technical industrial problems.

The Reading Iron Company announces the appointment of E. W. McHenry as district sales representative at Houston, Tex., and G. E. Tyson at New Orleans.

Cutler-Hammer, Inc., has made P. S. Jones manager of the New York office and T. S. Towle manager at Pittsburgh.

Blaw-Knox Company, Pittsburgh, has effected a merger with the A. W. French Company of Chicago and will operate it as a separate division.

Ajax Electrothermic Corporation announces that it has available a new industrial film for use at meetings of technical organizations. It shows in detail the operation of high frequency furnaces in melting and pouring metals.

Century Electric Company has opened new offices at 718 Continental Bank Bldg., Indianapolis, Ind., and Union State Bank Bldg., Omaha, Neb.

The Chain Belt Company, Milwaukee, has appointed R. A. Shilbauer advertising manager.

The Prest-O-Lite Company, New York, has opened a sales plant at 925 Houston St., Houston, Tex., under A. J. Harrower.

Dayton-Dowd Company, Quincy, Ill., has appointed D. C. Ephilstone as Maryland representative at 120 South Calvert St., Baltimore.

J. T. Baker Chemical Company, Phillipsburg, N. J., has made Donald H. Coale assistant sales manager and L. J. Etman manager for New York.

Corning Glass Works, Corning, N. Y., have made the following promotions: G. B. Hollister, vice-president on executive committee; W. H. Curtiss, vice-president; J. L. Peden, director of sales.

The Harshaw Chemical Company is the new name adopted by the Harshaw, Fuller E. Goodwin Company, Cleveland, at a recent meeting. The following officers were also elected: W. S. Harshaw, president; R. S. Wensley, W. J. Harshaw, O. J. Hall, W. R. Wensley, vice-presidents; D. T. Perry, secretary-treasurer.

The Struthers-Wells Company, Warren, Pa., has made E. C. Alford district engineer for the New York territory.

The Wm. H. Ziegler Company of Minneapolis, Minn., is opening up a branch office in Fargo, North Dakota, in charge of O. H. Strand.

Barber-Greene Company, Aurora, Ill., have recently opened a new office in Cedar Rapids, Iowa, at 527-528 Merchants National Bank Building, under the supervision of Jack Marson.

MARKET CONDITIONS *and* PRICE TRENDS

Imported Casein Fills Greater Part of Domestic Requirements

Receipts From Foreign Markets Last Year Were the Largest on Record

WITH THE publication of statistics covering importations of casein in December, it has been possible to bring up to date comparisons of the relative importance in our markets of the imported and domestic products. The import figures show that the position of advantage not only has been held for many years by the foreign-made article but that the trend at present is strongly in favor of an enlargement of imports. In fact arrivals from outside countries reached a larger total in 1928 than in any preceding year in the history of the industry.

Assuming that the carryover of stocks from year to year is fairly constant, it may be deduced that domestic consuming requirements will approximate the volume of home production plus the quantities imported. On that basis, it is apparent that consumption has increased in recent years. While competing materials have made inroads, the growth of consuming industries and the development of new outlets have expanded the use of casein with the probability that the trade will continue along progressive lines.

PRIOR to the world war the greater part of casein imports came from France. That country not only was in a favorable competitive position but in addition, French casein was given the preference because of its uniformity of quality. At that time the Argentine was not a large producer of casein and its total exports ran around 5,000,000 lb. a year. From 1919 up to the present, the Argentine forged ahead as a producing country and has held the premier position as a shipper to this country.

Up to 1922 casein had been on the free list but in that year an impost of 2½c. per lb. became effective. This acted as a stimulus to domestic production but failed to check the inflow from foreign markets and imports in 1923 were the largest for any year up to that time, in fact, they were exceeded only by those for 1928. Casein is included among the materials for which tariff changes are now being advocated. Consumers are requesting that it be restored to the free list while producers are petitioning for a duty of 8c. per lb.

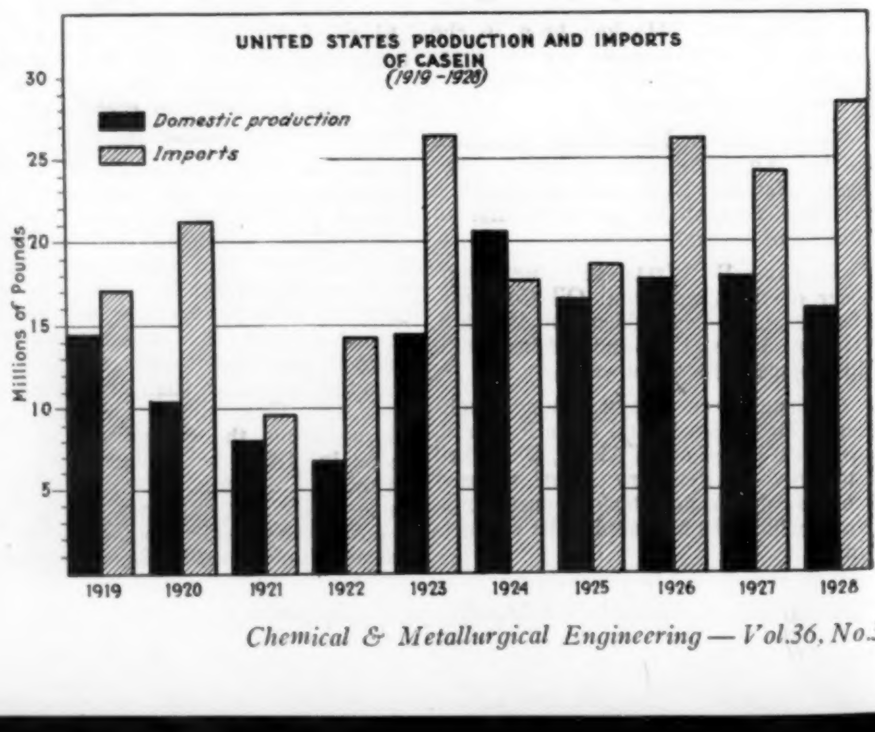
The largest outlet for casein is in the manufacture of coated paper, that industry taking more than 70 per cent of all offerings. The second largest use is in the production of adhesives. It also is used in paints, in making galalith, in wall paper, insecticides, and in numerous miscellaneous industries.

Production and Imports of Casein 1919-1928

	Domestic Production Lb.	Imports Lb.	Total Supply Lb.	Production Per Cent of Supply	Import Per Cent of Supply
1919	14,407,394	17,076,936	31,484,330	45.76	54.24
1920	10,494,393	21,238,822	31,733,215	33.07	66.93
1921	8,076,000	9,717,238	17,793,238	45.39	54.61
1922	6,927,000	14,342,498	21,269,498	32.57	67.43
1923	14,548,000	26,489,992	41,037,992	35.45	64.55
1924	20,759,000	17,749,985	38,508,985	53.91	46.09
1925	16,660,000	18,803,816	35,463,816	46.97	53.03
1926	17,953,000	26,281,126	44,234,126	40.58	59.42
1927	18,033,000	24,209,504	42,242,504	42.69	57.31
1928	16,000,000	28,651,215	44,651,215	35.83	64.17

REVERTING to prewar years, it is found that relatively large importations were necessary in order to round out home requirements. As milk is the basic raw material necessary for the manufacture of casein it is clear that economic conditions are responsible for the failure of the home industry to expand in a degree commensurate with consuming demands. This is explained on the grounds that this country is a large consumer of whole milk; that a large part of the skim milk supply is used as a feedstuff in the farming sections; and that a more lucrative outlet for skim milk has been found in the manufacture of powdered milk. According to census returns, powdered milk—exclusive of that produced from buttermilk—amounted to 88,820,703 lb. As 100 lb. of milk will produce an average of 9 lb. of powdered milk, this represents a consumption of 986,896,700 lb. of milk.

After conducting an investigation into producing costs in this country and in the Argentine, the Tariff Commission reported in 1926, that to ascertain the cost of raw material, skimmed milk, per pound of casein is necessary for the ascertainment of the differences in the cost of production of casein in the United States and in the principal competing country. The data obtained in Argentina are wholly inadequate for the ascertainment of a unit cost of raw material. An effort to use what data were obtained, with a view to computing a raw material cost, results only in the construction of an artificial cost by an erroneous and indefensible method. A similar application of that method to data obtained in the United States would result in four different raw material unit costs, no one of which seems to be in accord with the other data secured.



MARKET APPRAISAL OF CHEMICAL INDUSTRY

Plans for recapitalizing the Skendandoa Rayon Corp. on a basis which will provide $3,000,000 new money and will enable the installation of two additional manufacturing units, thereby tripling plant capacity, have been outlined in a letter to stockholders.

The Glidden Co. has offered common stockholders the right to subscribe to 100,000 additional shares of common stock at $35 a share in the ratio of one share for every five shares held. Meeting of stockholders has been called for March 28 to vote on increase in common stock to 600,000 shares from 500,000.

Stockholders of United Piece Dye Works have voted in favor of increasing authorized no-par common stock to 900,000 shares, from 450,000.

American Commercial Alcohol Corp. of California, newly formed and wholly owned subsidiary of American Commercial Alcohol Corp., has arranged to acquire all the assets of the Industrial Solvents Corp. of Sausalito, California. Industrial Solvents Corp. has an allotment for 1929 of 1,650,000 gal. of alcohol under government quota system.

Mathieson Alkali Works, Inc., has declared a stock dividend of three shares for one and authorized an increase in the no-par common stock to 1,000,000 shares, from 200,000 shares. Company also declared regular quarterly dividends of $1.50 on the common and $1.75 on the preferred, both payable April 1 to stock of record March 15. The stock dividend payable date is to be fixed later.

Stockholders of New Jersey Zinc Co. have approved change in par value of capital stock to $25 from $100, four new shares to be exchanged for each share of $100 par. It is expected the new $25 par certificates will be ready for issuance April 1.

The first annual report of American Commercial Alcohol Corp. has been issued covering eight months from April 25 to December 31, 1928, showing net profit of $710,861 after depreciation, interest, federal taxes, etc., equivalent after allowing for eight months dividend requirements on 7 per cent preferred stock, to $6.96 a share earned on 87,382 no-par shares of common stock.

Financial reports covering the results of operations for 1928, recently have been issued by the following companies:

	Profits 1927	Profits 1928
Armstrong Cork	$3,752,553	$3,931,963
Beech Nut Packing	2,301,464	2,768,768
Bristol-Myers	1,047,688	1,609,191
Celanese	2,754,071	2,356,976
Corn Products	11,905,289	13,192,974
Eagle-Picher Lead	—463,227	1,151,178
Fisk Rubber	2,620,721	—8,791,251
Goodrich, B. F. Co.	11,780,306	3,513,023
Lehn & Fink	1,277,142	1,906,269
Monsanto	62,622	944,438
National Lead	4,929,396	5,872,496
Phillips Petroleum	4,937,931	5,960,171
Union Carbide	25,340,660	30,577,382

Price Range for Jan.—Feb. High	Low	Stock	—Price Range in February— Feb. 1	High	Low	Feb. 28
114⅞	96⅞	Air Reduction	110	111⅛	101⅝	110
16	9	Ajax Rubber	10¼	10⅝	9	9⅞
305	241	Allied Chemical	285	375	275	303
123½	121	Allied Chemical, pf	....	123½	122	....
23⅝	18½	Am. Ag. Chemical	21⅛	21½	18½	19
73¾	61½	Am. Ag. Chemical, pf	69½	70	61½	64
80	50	American Cyanamid, B	69¼	70⅝	58¾	65⅛
10	8½	Am. Hide & Leather	8⅜	8¾	8½	8⅛
81½	60½	American Metals	71⅞	81½	69	72⅛
40¾	26⅛	Am. Solvents & Chemical	36	40¾	35½	38⅛
45¼	33	Anglo-Chile Nitrate	41	43	35¼	41⅛
110⅞	91⅞	Archer-Daniels-Midland	103¾	104⅛	91⅞	94¾
27⅛	19	Assoc. Dyeing & Printing	23	27⅛	19	23
115	99⅛	Atlas Powder	111⅛	112	99⅛	....
28⅛	20	Beacon Oil	22	24½	20	24
101	85½	Beechnut Packing	95⅛	95⅛	85½	90
89⅛	81⅛	Bon Ami, A	....	85¼	81½	....
109⅞	92⅜	Bristol-Myers	106⅜	109⅞	99⅝	104⅝
29⅞	27	California Petroleum	....	28	27	....
57⅛	41⅛	Celanese	45⅝	57⅛	43⅛	52½
118	110	Celanese, pf	....	118	110	112
28⅝	20½	Certainteed	24½	25⅛	20½	22⅛
50	45⅛	Chickasha Cotton Oil	48⅛	48¾	45⅛	....
274	225½	Commercial Solvents	241½	274	225½	268
91⅞	83	Corn Products	88	90⅞	83	85⅛
69⅛	58⅛	Davison Chemical	68½	68⅞	58⅛	61⅝
64⅞	55⅛	Devoe & Raynolds	59⅝	64⅞	57	58⅞
115⅛	112	Devoe & Raynolds, pf	115	115⅛	114⅛	115
680	493	Du Pont	675	680	675	675
118⅞	115¾	Du Pont, 6 pc. lb	....	118	117	....
194⅛	181	Eastman Kodak	184⅛	194⅛	181	184⅝
250	220⅛	Firestone Tire	241	242⅛	220⅛	236
20⅜	15⅝	Fisk Rubber	19	19	15⅝	17⅜
84⅝	72	Fleischmann Co.	78	78⅞	72	74⅝
54⅞	45⅛	Freeport Texas	51⅛	51½	45⅛	47⅞
44½	36⅛	Glidden Co	42	43⅞	38⅛	43
105	103⅛	Glidden Co., pf	....	105	104⅛	104⅝
82	66⅝	Gold Dust	77⅞	78⅞	66⅝	72⅝
105¾	87⅛	Goodrich Co.	99	101	87⅛	96⅜
107	82⅛	Houston Oil	89¾	93	82⅛	84
135	120	Industrial Rayon	....	132	120	....
17⅞	14½	Int. Ag. Chemical	16½	16⅞	14½	14½
89⅛	79½	Int. Ag. Chemical, pf	....	85⅛	79½	81
35	27⅛	International Paper	34⅝	34½	29⅝	31½
90	55⅛	International Salt	75	90	73	....
23⅞	18	Kelly-Springfield	22½	22⅝	18	19⅝
25	19⅛	Lee Rubber & Tire	22⅞	23	19⅛	22
68⅛	58⅛	Lehn & Fink	64⅞	68⅛	58⅜	61
220½	179	Libby-Owens	208	220½	200	210
113⅞	79	Liquid Carbonic	107	109⅞	79	86⅞
218	175	Mathieson Alkali	....	218	179	201
....	....	Monsanto Chemical	....	....	....	....
43½	35	Nat'l Dist. Products	39⅛	43½	35	41½
158⅛	132	National Lead	148⅛	151½	141	151⅝
325	279½	New Jersey Zinc	310	319⅛	302½	....
74⅝	64⅛	Ohio Oil	66⅛	69⅛	64⅝	....
98⅞	81	Owens Bottle	92⅛	98⅞	91	94⅛
80⅞	73	Palmolive Peet	77⅞	77⅞	73	....
47	37½	Phillips Petroleum	39⅞	40⅛	37½	83¾
76⅛	64	Pittsburgh Plate Glass	....	72½	67½	....
85	63⅛	Pratt & Lambert	82½	85	77	....
28⅛	23½	Pure Oil	24⅞	25⅞	23½	24½
88⅝	85	Sherwin-Williams	....	87	85	....
28⅝	23⅛	Silica Gel	27⅞	28⅛	26⅛	27⅛
45	36	Sinclair Oil	38⅝	42½	36	39½
40	33	Skelly Oil	35⅞	36⅞	33	34⅛
73⅛	64	Standard Oil, Cal	67⅛	68⅞	64	67⅛
55⅛	48	Standard Oil, N. J.	50	51⅛	48	49⅞
45½	38⅝	Standard Oil, N. Y.	41⅛	42	38⅝	40½
9⅞	4⅞	Standard Plate Glass	7⅞	7⅞	5⅛	5⅞
68⅛	57½	Sun Oil	61	62	57½	58
18	17⅛	Swan & Finch	....	....	....	....
20⅞	17⅛	Tennessee Copper & Chemical	19	20⅞	18⅝	19⅝
68	57⅞	Texas Corp	60⅛	61⅞	57⅞	59⅞
82	72½	Texas Gulf Sulphur	78⅞	78⅞	72½	75⅞
22	17⅛	Tidewater Oil	18⅞	19⅛	17⅛	18⅞
550	440⅛	Tubize Silk	490⅛	505⅛	440⅛	460
227⅞	196⅛	Union Carbide	224⅞	227⅞	202	216
52⅛	46	Union Oil, Cal	49⅛	50⅛	46	50⅛
114	93	United Piece Dye	....	108⅛	93	105
154⅞	128	U. S. Ind. Alcohol	152½	154	134⅝	146⅝
35⅛	24½	U. S. Leather	30⅛	31⅛	24½	27⅞
56⅛	42	U. S. Rubber	52⅛	56⅛	46⅞	55⅞
130⅞	105⅛	Vacuum Oil	112⅞	124⅞	113⅞	121⅝
116⅛	95½	Vanadium Corp	108⅛	116⅛	101	108⅝
94⅛	82	Vick Chemical	90	91⅛	83⅛	....
24⅛	18⅛	Va. Ca. Chemical	23⅛	23⅞	18⅝	20
97⅛	94⅛	Va. Ca. Chemical, pf	97	97⅛	95	....
110⅞	93⅛	Wesson Oil	104⅛	110⅞	95⅛	97⅞
13⅛	11⅛	Wilson & Co.	11⅛	12	11⅛	11⅞
98.22	81.26	Average for 90 stocks	89.74	96.79	85.67	88.26

ECONOMIC INFLUENCES *on production and consumption of* CHEMICALS

Activity in Industrial Lines Aids Production of Chemicals

Consuming Demand for Raw Materials Maintained on a Large Scale

PREDICTIONS of an active first quarter of the year in chemical producing and consuming industries have been verified by developments to date. Basic industries are maintaining a high rate of production and this has a beneficial result on the movement of raw materials. Steel manufacture, which is one of the ranking indexes of business activity, reached record proportions in February. The daily output of steel ingots averaged 180,198 tons for the 24 working days of that month. This compares with the previous record of 172,144 tons per day established in October, 1928. Taking annual capacity at 58,627,910 tons, operations in February represented 95.59 per-cent of capacity compared with 85.84 per cent for February, 1928.

Reports from the building trades are somewhat mixed as they indicate a decline in certain types of construction, notably frame dwellings, but the decline is more than offset by gains in heavy construction.

Manufacturers of rubber products have been operating at an unusually high rate and consumption of crude rubber in January is estimated to have exceeded 43,000 tons, which replaces the former record made in August, 1928.

INDUSTRIAL production during January, after allowance for seasonal conditions, showed a gain over both the preceding month and January, 1928, according to the weighted index of the Federal Reserve Board. The principal increases over January, 1928, occurred in iron and steel, textiles, automobiles, paper and printing, leather and shoes, cement, brick and glass, petroleum refining, rubber tires and tobacco manufactures. Mineral production, after adjustment for seasonal variation, also showed gains over both the proceeding month and January of last year.

Stocks of commodities held at the end of January were greater than a year ago. Holdings of raw materials and manufactured goods were each larger than at the end of January, 1928.

The general index of unfilled orders showed a decline from a year ago but was greater than in December. Forward business for textiles at the end of January was larger than at the end of either prior period. Unfilled orders for iron and steel, transportation equipment, and lumber showed declines from January, 1928, but were larger than in December.

Chemical Production Ranks High

The Census of Manufactures has just issued a summarization of data collected at the biennial census of manufactures. The report classifies manufacturing industries in fifteen grand divisions. From the standpoint of value of products the Chemical and Allied Products division holds third place.

Data for Chemical and Allied Products manufacture are given as follows:

	1925	1927
No. of establishments	8,871	8,939
Wage earners	381,075	394,817
Wages	506,386,054	534,947,864
Cost of materials	4,184,910,627	4,061,009,903
Value of products	6,438,027,055	6,404,914,348
Value added by manufacture	2,253,116,428	2,343,904,445

Activities in chemical producing and consuming industries for January may be compared with those for the corresponding period of 1928 from the following figures:

Production	Jan. 1928	Jan. 1929
Acetate of lime, 1,000 lb	12,519	11,580
Alcohol, ethyl, 1,000 gal	13,050	15,282
Methanol, crude, gal	699,551	624,047
Methanol, refined, gal	496,073	494,501
Nitrate of soda, Chile, ton	242,800	274,500
Turpentine, wood, bbl	5,771	7,347
Rosin, wood, bbl	29,200	37,765
Turpentine, gum, receipts, bbl	7,764	8,175
Rosin, gum, receipts, bbl	41,160	45,203
Byproduct coke, 1,000 tons	3,897	4,360
Plate glass, 1,000 sq.ft	8,205	11,425
Glass containers, 1,000 gross	2,207	2,367
Explosives, 1,000 lb	29,607	33,596
Automobiles, trucks, no	26,082	51,537
Passenger cars, no	205,646	350,617
Superphosphate, ton	358,008	416,679
Consumption		
Cottonseed oil, bbl	267,310	315,839
Wool in textile trade, grease equivalent, 1,000 lb	45,087	54,031
Cotton, in textile trade, bales	586,142	668,389

MANUFACTURING activities in lines which call heavily upon chemicals as raw materials, generally, make a favorable comparison with the corresponding period of last year. The tanning industry is still among the exceptions to the general rule and demand for chemicals from that quarter for the year to date has fallen behind that of a year ago. Definite figures representing operations in some branches of the chemical industry and in certain consuming trades are available for January and offer interesting comparisons with the figures for January, 1928.

It will be noted that production of superphosphates was high in January and the output of sulphuric acid by fertilizer manufacturers in January was placed at 204,995 tons, which represents an increase over the three preceding months. Sales of fertilizer, however, in the cotton-growing states have run considerably below the totals of a year ago. This may have an effect on future productive activities in fertilizer manufacture but later buying of the finished product may offset the slower early demand.

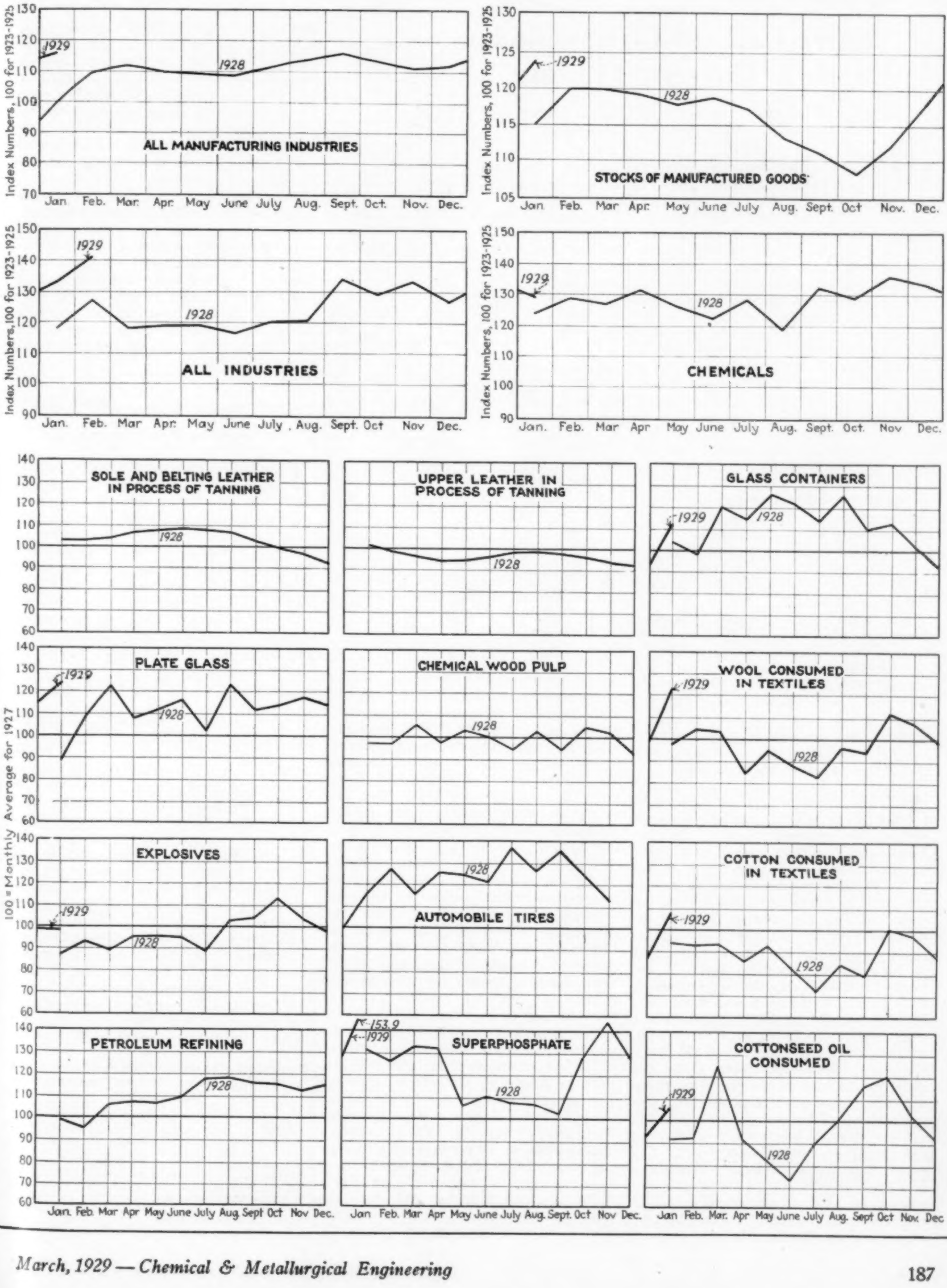
On a basis of consumption of electrical energy, *Electrical World* deduces that manufacturing operations in all lines in February established a record total and surpassed the January rate by 6 per cent with a gain of 14 per cent over February, 1928. On this comparison, material progress was recorded in the output of automobiles and parts, rubber gods, and chemicals and allied products. The textile industry also showed gains over last year and leather was reported at a gain over the preceding month but showed a 14 per cent decline as compared with the output of February, last year.

Sales of Lime Decreased Slightly in 1928

ESTIMATED sales of lime by producers in the United States in 1928 amounted to 4,395,000 short tons, valued at $36,600,000, according to estimates furnished by lime manufacturers to the United States Bureau of Mines, Department of Commerce. This is a decrease of less than 1 per cent in quantity and 5 per cent in value as compared with sales of 4,414,932 tons, valued at $38,638,413 in 1927. The estimated sales of hydrated lime, which are included in these figures, amounted to 1,568,000 tons valued at $13,395,000, a decrease of 2 per cent in quantity and 8 per cent in value from 1,596,906 tons, valued at $14,581,695 produced in 1927. The average unit value of all lime showed a decrease from $8.75 a ton in 1927 to $8.33 in 1928.

Chemical lime in most cases was reported in equal or increased demand. The sales of this product in 1927 was 1,943,199 tons, valued at $15,437,783. For 1928 the estimated production is 2,100,000 tons. Included in chemical lime the sales of refractory lime (dead-burned dolomite) in 1928 were estimated by the producers at 447,400 tons, compared with 374,415 tons in 1927.

ACTIVITY IN PRODUCING AND CONSUMING INDUSTRIES



MARKET CONDITIONS *and* PRICE TRENDS

Active Call for Chemicals Features Current Trading

Inquiry in Spot Market Covers Wide Range of Selections

WHILE contract deliveries are accounting for the greater part of the movement of chemicals, the spot market is showing considerable activity. Buying interest is scattered over a wide range of selections and in addition to jobbing lots there has been a call for round lots of many chemicals.

In some cases recent buying has been above normal judged by standards of preceding years. For instance, the automobile trade is reported to have been a heavy buyer of nickel salts and recent advances in sales prices are attributed to the gain in consumption which taxed productive capacities and caused a scarcity in spot supplies. Demand for chromic acid also has gained ground and production is on a much larger basis than was the case a few years ago.

One of the outstanding features in the market consists in the large part of production which has been sold ahead. This is true of the ammonia products, caustic soda, soda ash, chlorate of soda, oxalic acid, benzene, solvent naphtha, xylene, and other chemicals.

The metal markets are attracting more than usual attention because of an upward price tendency which is affecting the metal salts. Copper sulphate and copper carbonate were marked up in price during the month under the influence of the metal and lead carbonate, sulphate, red lead, litharge, and orange mineral were affected in a similar way as a result of advances in pig lead.

AS THE importers did not appear at the barium chloride hearing March 5 and as the representatives of the domestic manufacturers made a good case, the indications are that the report of the U. S. Tariff Commission will be tantamount to a recommendation for an increase of fifty per cent in the duty on that commodity. At the hearing emphasis was placed on the very low cost of the Belgium product. Much of the market formerly supplied by Germany, both in the country and abroad, has been pre-empted by the Belgians. Their 1928 costs were given as $1.04 per lb. as compared with a cost of $1.26 in Germany. Domestic costs were not made public, due to the fact that there are only two important producers. The publication of domestic costs would reveal confidential information concerning the operations of individual firms. The commission found, however, that there is a difference in costs of production of more than 1⅞ cents per pound which is the maximum increase which could be allowed under the flexible provisions of the law. Incidentally, the market for barium chloride has shown a strengthening tendency.

Leading producers have announced a reduction in the sales prices for different solvents. One price schedule recently issued quotes as follows:

	Less Than 50 Gals.	L.C.L. Lots	C.L. Lots	Tank Cars
	Price, Cents per Lb.			
Cellosolve	20	18	17	16
Cellosolve acetate	23	21	20	19
Butyl cellosolve	27	25	24	23
Methyl cellosolve	23	21	20	19
Butyl carbitol	30	28	..	..
Carbitol	20	18	17	..
Ethyl glycol	28	26	25	..
Diethylene glycol	12	11	10	..
Ethylene dichloride	7	6	5	..
Eth. dich. mixture	8	7	6	..
Dichlorethyl ether	7	6	5	..
Triethanolamine	60	55	..	..

Above prices are f.o.b. Charleston, W. Va., with the exception of cellosolve acetate which is offered f.o.b. Baltimore.

A STATISTICAL canvass made by the Bureau of Mines places domestic production of sulphur in 1928 at 1,981,873 long tons compared with 2,111,618 long tons in 1927 or a decrease of 6 per cent. The shipments in 1928 were record-breaking, 2,082,924 tons, valued at approximately $37,500,000, compared with 2,072,109 tons, valued at approximately $38,300,000, in 1927. Stocks on hand at the mines decreased approximately 100,000 tons in 1928 and totaled about 2,000,000 tons at the end of the year, the smallest since 1921. Two new properties contributed to the sulphur production of Texas in 1928, those of the Union Sulphur Co. at Wharton, Texas, and the Duval Texas Sulphur Co. at Benavides, Texas. Texas accounted for 99.88 per cent of the total production in 1928, and, with the shipments of sulphur from stocks in Louisiana, for 99.87 per cent of the shipments. Increased shipments of sulphur were reported for Nevada and Utah.

According to the same authority the output of pyrites decreased from 215,786 long tons, valued at $804,006, in 1927, to 182,049 tons, valued at $605,459, in 1928, or nearly 16 per cent in quantity. The quantity sold or used by producing companies also showed a large decrease, from 206,724 tons in 1927 to 179,484 tons in 1928, or 13 per cent. California and Virginia produced the entire tonnage recorded for both 1927 and 1928.

Our consular office at Oslo recently reported that exports of pyrites from Norway for the first eleven months of last year were 300,000 metric tons, which surpassed the total for any preceding year. The greater part of these exports went to Germany. In reviewing our export trade in sulphur last year it is found that shipments to Germany fell off 49,852 tons as compared with those for 1927. Hence, it is evident that Norwegian pyrites is affecting our export trade in sulphur.

In spite of increasing domestic consumption the United States is maintaining its position as the world's second largest exporter of caustic soda, according to the Department of Commerce. In the world's foreign trade in caustic soda, which totals about 220,000 tons annually, the United States supplies about 60,000 tons or 27 per cent which is 10 per cent its national production.

Decline in Value of Naval Stores Production

THE Department of Commerce announces that, according to data collected in the recent biennial census of manufactures, the establishments engaged primarily in the distillation of turpentine and rosin from crude gum reported products for the crop year ended March 31, 1928, valued at $39,902,971, a decrease of 5.8 per cent as compared with $42,364,413 for the crop year ended March 31, 1926, the last preceding census year. These establishments reported a total production of 31,549,082 gal. of turpentine and 2,071,813 bbl. (of 500 lb.) of rosin.

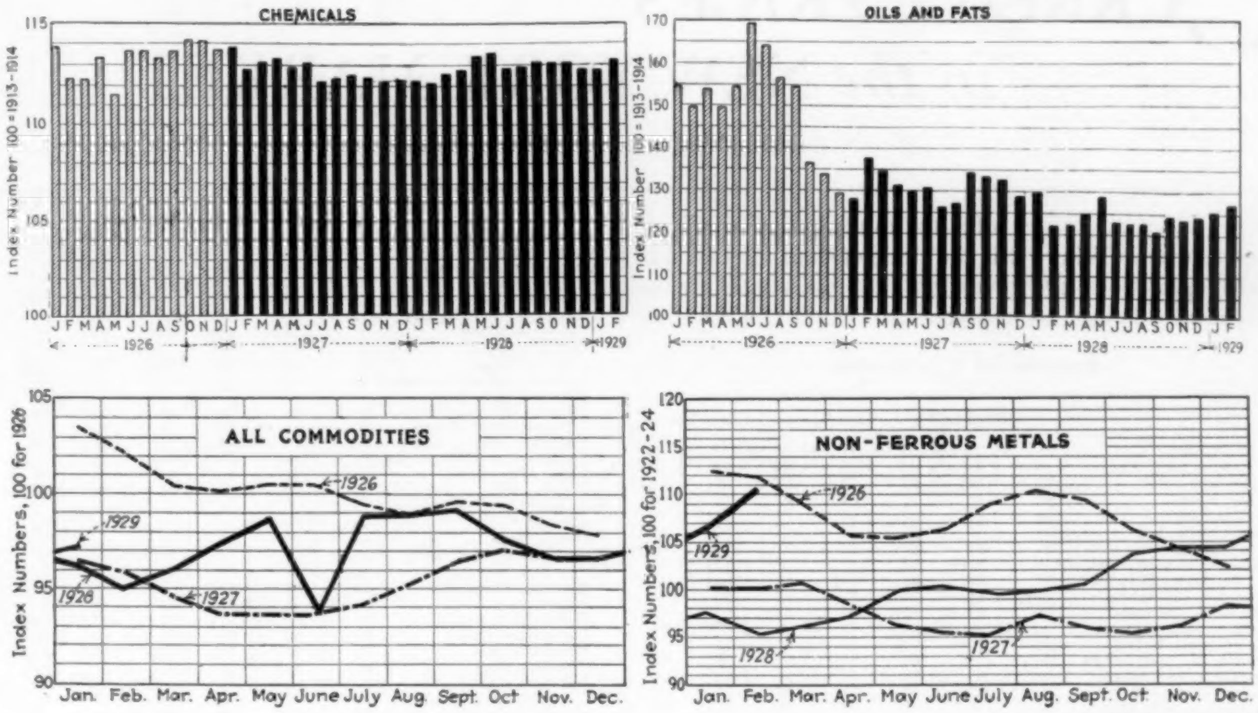
This industry embraces establishments engaged primarily in the distillation of turpentine and rosin from crude gum, a semifluid exudation from certain species of pine trees. No data for establishments reporting products valued at less than $5,000 are, however, tabulated.

In addition, considerable quantities of turpentine and rosin are made by the distillation of wood, both by the steam-solvent process and by the destructive process. During the calendar year 1927 the production by these processes amounted to 4,390,796 gal. of turpentine and 452,167 bbl. of rosin. These quantities represent increases of 31.5 per cent and 39.3 per cent, respectively, as compared with the corresponding figures for the crop year 1925-1926.

Production of Turpentine and Rosin from Crude Gum, by States, for Crop Year Ended March 31, 1928

State	Turpentine Gal.	Rosin Bbl. of 500 lb.
United States	31,549,082	2,071,813
Alabama	2,179,710	144,381
Florida	10,275,713	711,852
Georgia	15,060,761	953,923
Louisiana and Texas	1,357,929	93,601
Mississippi	1,879,418	117,688
North Carolina and South Carolina	795,551	50,368

CHEM. & MET. *Weighted Indexes of* PRICES



U. S. Dep't of Labor — *Engineering & Mining Journal*

Weighted Index for Chemicals Tends Toward Higher Levels

PROMINENT among the factors which are influencing the price trend for chemicals at present is the position of the metal market. This is especially true of lead and copper and the reflection of this has been seen in higher price schedules for the lead and copper salts. Conditions underlying the chemical market in general, likewise, are more favorable to increases than to decreases in values. The tariff situation remains in the offing and while it is probable that changes in duties will not be wide-sweeping, it is equally probable that whatever changes are made will have a bullish effect on the market.

In addition to the firmness of prices occasioned by the position of raw materials there is an added strength brought about by the large per cent of production which has been sold ahead in the case of many chemicals. In other words, producers are moving so much of their outputs against contracts that there is less than usual competition in the spot market and the close relation between production and consumption is an indication and can easily lead to upward price revision.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**113.15**
Last month	112.75
March, 1928	112.60
March, 1927	113.09

The majority of chemicals hold a steady price course with demand active enough to prevent price-cutting. The index number moved upwards under the influence of advances in copper sulphate, and lead carbonate. All copper and lead salts were strengthened by the metal markets.

QUANTITY production has enabled producers of certain solvents to quote at lower levels, but methanol shows a firm front. Industrial alcohol also is steadily held. The position of the alcohol market is fortified not only by the high prices asked for blackstrap molasses, but also by the control over production and by the fact that unsold stocks have been reduced in recent months. Consolidations among alcohol producers likewise may be regarded as a steadying factor on values as competition is thereby reduced to a minimum and there is less probability of distressed lots finding their way to the market.

Chlorate of potash of foreign origin has dominated domestic markets for a long time and the lessening of competition from domestic producers brings up the possibility of total cessation of domestic production.

Fertilizer chemicals have shown but little variation in position and this condition may continue for some time, but a far-off view brings the conviction that values for such materials as nitrate of soda and sulphate of ammonia will be affected by competitive conditions with producers of nitrogen from the air having much to do with establishing price levels.

PRICES for vegetable oils are subject not only to the influences of conditions in home markets but also to developments in foreign producing centers. Cottonseed oil which exerts the greatest influence on the average price appears to be working into a stronger position and the fact that no oil is being tendered in the New York market on March contracts indicates that the supply is in strong hands and may mean that values will be advanced.

Linseed oil has held a steady course throughout the month and there is not much in sight upon which to base a belief in a material change in either direction. Coconut oil has been unsteady with offerings rather heavy and prices none too steady.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**127.30**
Last month	127.76
March, 1928	122.35
March, 1927	134.38

While the cottonseed oil market closed at a slight advance, lower price levels were in force for China wood, coconut, corn, and peanut oils and the weighted index number showed a recession. Tallow also was fractionally lower.

CURRENT PRICES
in the NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to March 13.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.14 -$0.15	$0.14 -$0.15	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.88 - 4.03	3.88 - 4.03	3.38 - 3.63
Boric, bbl.	lb.	.06½- .07	.06½- .07	.08½- .08¾
Citric, kegs	lb.	.46 - .47	.46 - .47	.45 - .47
Formic, bbl.	lb.	.11 - .12	.11 - .12	.11 - .12
Gallic, tech., bbl.	lb.	.50 - .55	.50 - .55	.50 - .55
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.11½- .12	.12 - .12½	.13½- .14
22%, tech., light, bbl.	lb.	.05½- .06	.05¾- .06	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - .90
Nitric, 36°, carboys	lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.11 - .11½
Phosphoric, tech., c'bys.	lb.	.08½- .09	.08½- .09	.08½- .09
Sulphuric, 60°, tanks	ton	11.00 -11.50	11.00 -11.50	10.50 -11.00
Tannic, tech., bbl.	lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl.	lb.	.38 - .39	.38 - .39	.36 - .37
Tungstic, bbl.	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p'f., bbl.	gal.	2.68½- 2.71	2.68½- 2.71	2.68½- 2.71
Alcohol, Butyl, dr.	lb.	.17¾- .18	.18¾- .19	.19 - .20
Denatured, 190 proof				
No. 1 special dr.	gal.	.48 -......	.48	.43 -......
No. 5, 188 proof, dr.	gal.	.48 -......	.48	.43 -......
Alum, ammonia, lump, bbl.	lb.	.03¾- .04	.03¾- .04	.03¾- .04
Chrome, bbl.	lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl.	lb.	.03 - .03¾	.03 - .03¾	.02¾- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg.	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Aqua ammonia, 26°, drums	lb.	.03 - .04	.03 - .04	.03 - .04
Ammonia, anhydrous, cyl.	lb.	.14 -......	.13½-......	.13 -......
Ammonium carbonate, powd. tech., casks	lb.	.12 - .13	.12 - .13	.10½- .14
Sulphate, wks.	cwt.	2.35 -......	2.30 -......	2.40 -......
Amylacetate tech., drums	gal.	1.75 - 2.00	1.75 - 2.00	1.75 - 2.00
Antimony Oxide, bbl.	lb.	.10½- .10¾	.10½- .10¾	.15 - .16
Arsenic, white, powd., bbl.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs	lb.	.09 - .10	.09 - .10	.09½- .10
Barium carbonate, bbl.	ton	58.00 -60.00	57.50 -60.00	50.00 -52.00
Chloride, bbl.	ton	65.00 -67.00	63.00 -70.00	56.00 -58.00
Nitrate, cask	lb.	.07½- .08	.07½- .08	.08 - .08½
Blanc fixe, dry, bbl.	lb.	.03½- .04	.03½- .04	.04 - .04½
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.02½- .03	.02½- .03	.04 - .04½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	4.50 -......	4.50 -......	3.50 -......
Arsenate, dr.	lb.	.06½- .07	.06½- .07	.07 - .08
Carbide drums	lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks.	ton	20.00 -......	20.00 -......	21.00 -......
Phosphate, bbl.	lb.	.08 - .08½	.08 - .08½	.07 - .07½
Carbon bisulphide, drums	lb.	.05 - .06	.05 - .06	.05½- .06
Tetrachloride drums	lb.	.06½- .07	.06½- .07	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.03 - .03½	.03 - .03½	.03½- .04½
Cylinders	lb.	.05 - .08	.05 - .08	.05½- .08
Cobalt oxide, cans	lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	16.00 -17.00	16.00- 17.00	14.00 -17.00
Copper carbonate, bbl.	lb.	.18½- .19	.17 - .17½	.17 - .17½
Cyanide, tech., bbl.	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	6.20 - 6.40	5.50 - 5.70	5.00 - 5.10
Cream of tartar, bbl.	lb.	.27½- .28	.27½- .28	.25½- .27
Diethylene glycol, dr.	lb.	.10 - .15	.10 - .15	.10 - .15
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.15 - 1.25
Ethyl acetate, drums	gal.	1.03 -......	1.03 -......	.83 -......
Formaldehyde, 40%, bbl.	lb.	.09½ .10	.09½- .10	.08½- .09
Furfural, dr.	lb.	.15 - .17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums	gal.	1.30 - 1.40	1.30 - 1.40	1.30 - 1.40
Refined, dr.	gal.	1.90 - 2.00	1.90 - 2.00	2.50 - 3.00
Glaubers salt, bags	cwt.	1.10 - 1.20	1.10 - 1.20	1.00 - 1.10
Glycerine, c.p., drums, extra	lb.	.15 - .16	.14 - .15	.17 - .18
Lead:				
White, basic carbonate, dry, casks	lb.	.08¾-......	.08¼-......	.08½-......
White, basic sulphate, sck.	lb.	.08 -......	.07¾-......	.08 -......
Red, dry, sck.	lb.	.11 -......	.10 -......	.10 -......
Lead acetate, white crys., bbl.	lb.	.14 - .14½	.13 - .13½	.13 - .13½
Lead arsenate, powd., bbl.	lb.	.13 - .14	.13 - .14	.12 - .13
Lime, chem., bulk	ton	8.50 -......	8.50 -......	8.50 -......
Litharge, pwd., csk.	lb.	.09¼-......	.09 -......	.09 -......
Lithopone, bags	lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags	lb.	.06 - .06½	.06½- .07	.07½- .08
Methanol, 95%, dr.	gal.	.55 -......	.55 -......	.53 -......
97%, dr.	gal.	.55 -......	.55 -......	.55 -......
Nickel salt, double, bbl.	lb.	.13 - .13½	.13 - .13½	.10 - .10
Single, bbl.	lb.	.13 - .13½	.13 - .13½	.10½- .11½

		Current Price	Last Month	Last Year
Orange mineral, csk.	lb.	$0.12¾-......	$0.12 -......	$0.11½-......
Phosphorus, red, cases	lb.	.55 - .57	.62 - .65	.62 - .65
Yellow, cases	lb.	.32 - .33	.32 - .34	.32 - .33
Potassium bichromate, casks	lb.	.08¼- .08½	.08¼- .08¾	.08½- .08¾
Carbonate, 80-85%, calc., csk.	lb.	.05½- .06	.05½- .06	.05½- .06
Chlorate, powd.	lb.	.07½- .08½	.07½- .08½	.08½- .09
Cyanide, cs.	lb.	.52 - .55	.52 - .55	.55 - .57
First sorts, csk.	lb.	.08½- .09	.08½- .09	.08½- .09
Hydroxide(c'stic potash) dr.	lb.	.07¼- .07¾	.07¼- .07¾	.07¼- .07½
Muriate, 80% bgs.	ton	36.40 -......	36.40 -......	36.40 -......
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07¾
Permanganate, drums	lb.	.16 - .16½	.16 - .16½	.15 - .16
Prussiate, yellow, casks	lb.	.19 - .19½	.19 - .19½	.18 - .19
Sal ammoniac, white, casks	lb.	.046- .05	.046- .05	.047- .05
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk	ton	16.00 -18.00	15.00 -17.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32 -......	1.32 -......	1.32 -......
Dense, bags	cwt.	1.35 -......	1.35 -......	1.35 -......
Soda, caustic, 76%, solid, drums, contract	cwt.	2.80 - 3.00	2.80 - 3.00	3.00 - 3.10
Acetate, works, bbl.	lb.	.05 - .05½	.05½- .06½	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.07 - .07½	.07 - .07½	.06½- .06¾
Bisulphate, bulk	ton	12.00 -15.00	12.00 -15.00	3.00 - 3.50
Bisulphite, bbl.	lb.	.03½- .03¾	.03½- .03¾	.03½- .04
Chlorate, kegs	lb.	.06½- .07	.06½- .07	.06½- .06¾
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.18 - .22
Fluoride, bbl.	lb.	.08½- .09½	.08½- .09½	.08½- .09
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Nitrate, bags	cwt.	2.15 -......	2.15 -......	2.40 -......
Nitrite, casks	lb.	.07½- .08	.07½- .08	.08 - .08½
Phosphate, dibasic, bbl.	lb.	.03½- .03¾	.03 - .03½	.03½- .03¾
Prussiate, yel. drums	lb.	.11½- .12	.11½- .12	.12 - .12½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.02½- .03½	.02½- .03	.03½- .04
Sulphite, crys., bbl.	lb.	.02½- .03	.02½- .03	.02½- .03
Strontium nitrate, bbl.	lb.	.09 - .09½	.09 - .09½	.09 - .09½
Sulphur, crude at mine, bulk	ton	18.00 -......	18.00 -......	18.00 -......
Chloride, dr.	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	1.55 - 3.00	1.55 - 3.00	1.55 - 3.00
Tin bichloride, bbl.	lb.	.15½-......	.15½-......	.15½-......
Oxide, bbl.	lb.	.53 -......	.54 -......	.57 -......
Crystals, bbl.	lb.	.37 -......	.37½-......	.38½-......
Zinc chloride, gran., bbl.	lb.	.06½- .06¾	.06½- .06¾	.06½- .06¾
Carbonate, bbl.	lb.	.10 - .11	.10 - .10½	.10 - .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.08½- .09	.08½- .09	.09 - .10
Zinc oxide, lead free, bag	lb.	.06½-......	.06½-......	.06½-......
5% lead sulphate, bags	lb.	.06½-......	.06½-......	.06½-......
Sulphate, bbl.	cwt.	2.75 - 3.00	2.75 - 3.00	2.75 - 3.00

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.13½-$0.14	$0.12¾-$0.13	$0.13½-$0.14
Chinawood oil, bbl.	lb.	.14½-......	.15 -......	.17 -......
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08 -......	.08¼-......	.08¾-......
Corn oil crude, tanks, (f.o.b. mill)	lb.	.09½-......	.09¾	.07¾-......
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09½-......	.09 -......	.07¾-......
Linseed oil, raw, car lots, bbl.	lb.	.102-......	.102-......	.098 ......
Palm, Lagos, casks	lb.	.09½-......	.09 -......	.08 -......
Niger, casks	lb.	.08¾-......	.08½-......	.07¾-......
Palm Kernel, bbl.	lb.	.09½-......	.09¾-......	.09 -......
Peanut oil, crude, tanks(mill)	lb.	.10¾-......	.10¾-......	.09½-......
Rapeseed oil, refined, bbl.	gal.	.86 - .87	.83 - .85	.82 - .84
Soya bean tank (f.o.b. Coast)	lb.	.09½-......	.10 -......	.09¾-......
Sulphur (olive foots), bbl.	lb.	.11 -......	.11¾-......	.10 -......
Cod, Newfoundland, bbl.	gal.	.65 - .67	.65 - .67	.63 - .65
Menhaden, light pressed, bbl.	gal.	.70 - .72	.63 - .65	.60 - .62
Crude, tanks(f.o.b. factory)	gal.	.48 -......	.48 -......	.44 -......
Whale, crude, tanks	gal.	.80 -......	.78 -......	......
Grease, yellow, loose	lb.	.08½-......	.07¾-......	.07¾-......
Oleo stearine	lb.	.11 -......	.10¾-......	.10½ ......
Red oil, distilled, d.p. bbl.	lb.	.09¾- .10	.09¾- .09½	.09¾ .09½
Tallow, extra, loose	lb.	.09¾-......	.09¾-......	.08¾-......

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl.	lb.	.80 - .85	.80 - .85	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.32 - .34	.32 - .34	.35 - .36
Aniline oil, drums, extra	lb.	.14½- .15	.14½- .15	.15 - .16
Aniline salts, bbl.	lb.	.24 - .25	.24 - .25	.24 - .25
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - .65

Coal Tar Products (Continued)

		Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr.	lb.	1.15 - 1.25	1.15 - 1.35	1.15 - 1.25
Benzidine base, bbl.	lb.	.67 - .70	.65 - .70	.70 - .72
Benzoic acid, U.S.P., kgs.	lb.	.57 - .60	.57 - .60	.58 - .60
Benzyl chloride, tech, dr	lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works	gal.	.23 - .25	.23 - .25	.24 - .25
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr.	lb.	.14 - .17	.14 - .17	.18 - .20
Cresylic acid, 97%, dr., wks	gal.	.73 - .75	.73 - .75	.61 - .62
Diethylaniline, dr	lb.	.55 - .58	.55 - .58	.58 - .60
Dinitrophenol, bbl.	lb.	.30 - .32	.30 - .31	.31 - .35
Dinitroteluen, bbl	lb.	.17 - .18	.17 - .18	.17 - .18
Dip oil, 25% dr.	gal.	.76 - .28	.28 - .30	.28 - .30
Diphenylamine, bbl.	lb.	.42 - .43	.43 - .45	.45 - .47
H-acid, bbl.	lb.	.60 - .63	.60 - .63	.63 - .65
Naphthalene, flake, bbl	lb.	.04½- .05	.05 - .06	.04½- .05
Nitrobenzene, dr.	lb.	.09 - .10	.09 - .10	.09 - .10
Para-nitraniline, bbl.	lb.	.55 - .56	.55 - .56	.52 - .53
Para-nitrotoluine, bbl.	lb.	.29 - .31	.28 - .32	.28 - .32
Phenol, U.S.P., drums	lb.	.13½- .14	.13 - .14	.18 - .19
Picric acid, bbl.	lb.	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr	lb.	1.75 - 1.90	1.75 - 1.90	3.00 -......
R-salt, bbl.	lb.	.44 - .45	.44 - .45	.47 - .50
Resorcinal, tech, kegs.	lb.	1.30 - 1.35	1.30 - 1.35	1.30 - 1.40
Salicylic acid, tech., bbl	lb.	.30 - .32	.30 - .32	.30 - .32
Solvent naphtha, w.w., tanks	gal.	.30 - .35	.30 -......	.35 -......
Tolidine, bbl.	lb.	.86 - .90	.86 - .90	.95 - .96
Toluene, tanks, works	gal.	.45 -.....	.40 -.....	.35 -.....
Xylene, com., tanks	gal.	.30 - .40	.30 - .35	.36 - .40

Miscellaneous

		Current Price	Last Month	Last Year
Barytes, grd., white, bbl.	ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl.	lb.	.16 .16½	.16½- .17	.17½- .18
China clay, dom., f.o.b. mine	ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:				
Carbon gas, black (wks.)	lb.	.08 - .13	.07½- .08	.06½- .07
Prussian blue, bbl.	lb.	.32 - .33	.31 - .33	.33 - .34
Ultramine blue, bbl.	lb.	.06 - .32	.08 - .35	.08 - .35
Chrome green, bbl.	lb.	.30 - .32	.27 - .30	.27 - .30
Carmine red, tins	lb.	6.00 - 6.50	5.25 - 5.50	5.50 - 5.75
Para toner	lb.	.70 - .75	.60 - .70	.80 - .90
Vermilion, English, bbl.	lb.	1.90 - 2.00	1.80 - 1.85	1.80 - 1.85
Chrome yellow, C. P., bbl.	lb.	.16 - .16½	.15½- .16	.17 - .18
Feldspar, No. 1 (f.o.b. N. C.)	ton	5.75 - 7.00	5.75 - 7.00	5.75 - 7.00
Graphite, Ceylon, lump, bbl	lb.	.08 - .08½	.08 - .08½	.08 - .09
Gum copal, Congo, bags	lb.	.07½- .08	.07½- .08	.07½- .08
Manila, bags	lb.	.16 - .17	.15 - .16	.15 - .18
Damar, Batavia, cases	lb.	.24 - .25	.22 - .23	.25 - .25
Kauri, No. 1 cases	lb.	.48 - .53	.48 - .53	.48 - .53
Kieselguhr (f.o.b. N. Y.)	ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.	ton	40.00 -......	40.00 -......	44.00 -......
Pumice stone, lump, bbl.	lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks	lb.	03 - .40	.03 - .40	.03 - .35
Rosin, H.	bbl.	9.25 -......	9.50 -......	9.75 -......
Turpentine	gal.	.58 -......	.59 -......	.60 -......
Shellac, orange, fine, bags	lb.	.61 -......	.61 -......	.56 - .59
Bleached, bonedry, bags	lb.	.58 - .60	.56 - .58	.54 - .56
T. N. bags	lb.	.44 - .45	.46 - .47	.52 - .54
Soapstone (f.o.b. Vt.), bags	ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.)	ton	9.50 -......	9.50 -......	10.50 -......
300 mesh (f.o.b. Ga.)	ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.)	ton	13.75 -......	13.75 -......	13.75 -....1

		Current Price	Last Month	Last Year
Wax, Bayberry, bbl.	lb.	$0.29 -$0.32	$0.31 -$0.32	$0.24 -$0.26
Beeswax, ref., light	lb.	.41 - .42	.41 - .42	.43 - .45
Candelilla, bags	lb.	.22 - .23	.22 - .24	.27 - .28
Carnauba, No. 1, bags	lb.	.36 - .38	.40 - .42	.55 - .60
Paraffine, crude 105-110 m.p.	lb	.04½- .05	.04½- .05	.05½- .06

Ferro-Alloys

		Current Price	Last Month	Last Year
Ferrotitanium, 15-18%	ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferromanganese, 78-82%	ton	105.00-.....	105.00-.....	100.00-.....
Spiegeleisen, 19-21%	ton	33.00-.....	32.00-.....	31.00-32.00
Ferrosilicon, 14-17%	ton	45.00-.....	45.00-.....	33.00-38.00
Ferrotungsten, 70-80%	lb.	1.04- 1.10	.95- .98	.90- .95
Ferro-uranium, 35-50%	lb.	4.50-.....	4.50-.....	4.50-.....
Ferrovanadium, 30-40%	lb.	3.15- 3.75	3.15- 3.75	3.15- 3.75

Non-Ferrous Metals

		Current Price	Last Month	Last Year
Copper, electrolytic	lb.	$0.20 -......	$0.16½ -......	$0.14½-......
Aluminum, 96-99%	lb.	.24 - .26	.24 - .26	.25 - .26
Antimony, Chin. and Jap.	lb.	.09½-......	.09½-......	.10½-......
Nickel, 99%	lb.	.35 -......	.35 -......	.35 -......
Monel metal, blocks	lb.	.28 -......	.28 - .28	.32 - .33
Tin, 5-ton lots, Straits	lb.	.48½-......	.49 -......	.58½-......
Lead, New York, spot	lb.	7.25 -......	6.75 -......	6.50 -......
Zinc, New York, spot	lb.	6.67½-......	6.70 -......	6.15 -......
Silver, commercial	oz.	.56½-......	.56½-......	.57½-......
Cadmium	lb.	.85 - .95	.85 - .95	.60 -......
Bismuth, ton lots	lb.	1.70 -......	1.70 -......	1.85 - 2.10
Cobalt	lb.	2.10 - 2.50	2.10 - 2.50	2.50 -......
Magnesium, ingots, 99%	lb.	.85 - 1.10	85 - 1.10	.75 - .80
Platinum, ref.	oz.	70.00- 72.50	70 00- 72.50	72.00-......
Palladium, ref.	oz.	38.00- 40.00	42 00- 46.00	50.00-52.00
Mercury, flask 75	lb.	123.50-......	118.00-......	128.00-......
Tungsten powder	lb.	1.10- 1 15	1.10- 1.15	1 05-......

Ores and Semi-finished Products

		Current Price	Last Month	Last Year
Bauxite, crushed, wks.	ton	$7.50- $8.00	$7.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post	ton	22.00- 25.00	22 00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens	ton	2.85- 3 00	2 85- 3 00	3.25- 3.75
Fluorspar, gravel, f.o.b. Ill.	ton	18.00- 20.00	17.00- 18.00	17.00-......
Ilmenite, 52% TiO_2, Va.	lb.	.00½ .00¾	.00½- .00¾	.00½-......
Manganese ore, 50% Mn., c.i.f. Atlantic Ports	unit	.34 - .37	.34 - .37	.36 - .38
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y.	lb.	.48 - .50	.48 - .50	.48- .50
Monazite, 6% of ThO_2	ton	130.00-......	130.00-......	120.00-......
Pyrites, Span. fines, c.i.f.	unit	.13 -......	.13 -......	.13½-......
Rutile, 94-96% TiO_2	lb.	.11 - .13	.11 - .13	.11 - .13
Tungsten, scheelite, 60% WO_3 and over	unit	11.25 -11.50	11.25 -11 50	11.25 -11.50
Vanadium ore, per lb. V_2O_5	lb.	.28	nom.	.25 - .28
Zircon, 99%	lb.	.03 -......	.03 -......	.03 -......

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Aluminum Plate Factory—J. C. Barrett Co., 516 Asylum St., Hartford, Conn., is having plans prepared for a 2 story, 40 x 100 ft. factory for the manufacture of aluminum plate. Estimated cost $40,000. Private plans.

Ball Bearing Factory — New Departure Mfg. Co., Bristol, Conn., plans the construction of a 120 x 404 ft. factory at Bristol, also 106 x 220 ft. factory at Meriden.

Brass Factory—Schlangen Mfg. Co., 2435 Irving Park Blvd., Chicago, Ill., is having sketches made for a 3 story factory for the manufacture of brass goods, barrel filling machinery, hardware, etc. Estimated cost $200,000. Architect not selected.

Brass Rolling Mill — Bridgeport Brass Co., R. Day, Gen. Mgr., Bridgeport, Conn., is having plans prepared for a 1 story, 75 x 200 ft. addition to brass rolling mill on Housatonic Ave. Estimated cost to exceed $40,000. Fletcher-Thompson Inc., 542 Fairfield Ave., Bridgeport, Conn., is architect.

Brick Plant Improvements—Thermo Fire Brick Co., Sulphur Springs, Tex., plans extensions and improvements to plant to include storage sheds, dryer sheds, installing up-draft kilns, etc. Estimated cost $35,000. Work will be done by owner's forces. Will purchase new machinery and equipment next year.

Bronze Plant—Aluminum Corp. of America, Oliver Bldg., Pittsburgh, Pa., has work under way on the first unit of aluminum bronze plant to consist of several buildings at Alcoa, Tenn. Estimated total cost $1,000,000. Private plans.

Carburetor Factory — Zenith Carburetor Co., Lycaste St., Detroit, Mich., will soon receive bids for a 2 story, 62 x 118 ft. factory. Donaldson & Meier, First National Bank Bldg., Detroit, are architects. Miscellaneous equipment will be required.

Cellsilk Plant — Cellosilk Mfg. Co., 410 Sullivan St., Chicago, Ill., have acquired the plant of American Malleable Iron Co. at Barrington, and plans alterations and additions to 2 story, 38 x 110 ft. factory for the manufacture of transparent materials.

Cement Barges, etc.—Marquette Cement Mfg. Co., 140 South Dearborn St., Chicago, Ill., awarded contract for four 175 x 35 x 8 ft. self-unloading bulk cement barges, 800 ton capacity in 3 hoppers, each 144 ft. in length for use on Mississippi River between Cape Girardeau Mo. and Memphis, Tenn. to Riter-Conley Co., Oliver Bldg., Pittsburgh, Pa. Estimated cost $120,000.

Chemical Factory — Carbide & Carbon Chemical Corp., Niagara Falls, N. Y., awarded contract for a 2 story factory to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $400,000.

Chemical Factory — Dewey & Almy Chemical Co., Harvey St., Cambridge, Mass., will build a 1 story chemical plant. Estimated cost $45,000. H. L. Kennedy, 80 Boylston St., Boston, is architect. Work will be done by separate contracts.

Chemical Plant—Louisiana Chemical Co., Bastrop, La., awarded contract for the construction of first unit of chemical plant to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $350,000.

Chemistry and Pharmacy Buildings — Purdue University, West Lafayette, Ind., had plans prepared for the construction of 3 story, 190 x 250 ft. chemistry building and 3 story, 50 x 130 ft. pharmacy building, etc. Estimated cost $325,000 and $150,000 respectively.

Compressed Gas Plant—Linde Air Products Co., subsidiary of Union Carbide & Carbon Corp., 30 East 42nd St., New York, N. Y., awarded contract for the construction of compressed gas plant at Byrne and Floyd Sts., Louisville, Ky., to Platoff & Bush ,122 West Liberty St., Louisville, Ky. Estimated cost $40,000.

Dental Plant Addition—Cleveland Dental Mfg. Co., W. L. Truesdell, Pres., 3307 Scranton Rd., Cleveland, O., is receiving bids for a 3 story addition to factory. Estimated cost $60,000. Anders & Reimers, Erie Bldg., Cleveland, are architects.

Extract Plant—Sethness Co., 659 Hobbie St., Chicago, Ill., awarded contract for the construction of a 140 x 200 ft. factory for the manufacture of flavoring extracts at Belle Plaine and Kilpatrick Aves. to Harman Engineering Co., 944 Rush St., Chicago, Ill. Estimated cost $270,000.

Feldspar Mill — Southern Feldspar Co., Toecane, N. C., plans the construction of a grinding mill. Estimated cost $100,000.

Furnace and Rolling Mill — Western Hardware & Steel Co., C. D. Hobbs, Granville Island, Vancouver, plans the con-

struction of a small electric furnace and rolling mill. Estimated cost $500,000.

Gas., Plant Addition — Illinois Power & Light Corp., M. L. Harry, Mgr., Decatur, Ill., plans addition to gas plant. Estimated cost $100,000.

Gas Plant—Fort William Gas Co., H. Price, Mgr., Fort William, Ont., plans the construction of a gas plant. Estimated cost $1,000,000. B. W. Barker, c/o owner, is engineer. Machinery and equipment will be required.

Gas Plant Additions—Pacific Gas & Electric Co., 245 Market St., San Francisco, Calif., is having plans prepared for the construction of a 500,000 cu.ft. gas tank, also additional purification and cooling facilities at Marysville, Calif. Estimated cost $120,000. Private plans.

Gas Plant Extension—National Utilities Co., Statesville, N. C., plans extension to gas plant. Estimated cost $25,000.

Gasoline Cracking Plant—Japan Gasoline Co. Ltd., Osaka, Japan, awarded contract for the construction of a plant to Arthur G. McKee & Co., 2422 Euclid Ave., Cleveland, O. Estimated cost $1,935,000.

Glass Factory—Bienenfeld Glass Works, 1539 Covert St., Ridgewood, N. Y., plans a 1 story, 100 x 180 ft. glass factory and warehouse at Covert St. and Wyckoff Ave. Estimated cost $80,000. A. Goldstein, 26 Court St., Brooklyn, is architect.

Glass Factory—Binswanger Plate Glass Co., Houston, Tex., awarded contract for a 2 story, 90 x 130 ft. warehouse for glass factory on Main St. to T. B. Hubbard, Shepherd St., Houston. Estimated cost $75,000.

Glass Plant — Hazel Atlas Glass Co., Wheeling, W. Va., awarded contract for a 4 story, 60 x 100 ft. warehouse for glass plant at Washington, Pa. to Hutter Construction Co., Fond du Lac, Wis. Estimated cost $200,000.

Heat Treating Plant — National Machine Products Co., 4850 Bellevue Ave., Detroit, Mich., awarded contract for a 1 story, 35 x 70 and 50 x 162 ft. heat treating plant to Bennige & McKinstrie, 4612 Woodward Ave., Detroit. Owner is in the market for equipment.

Iron Cement Factory—Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City, N. J., will soon award contract for a 2 story, 25 x 60 ft. addition to iron cement factory at Communipaw and Harrison Aves. Estimated cost $40,000. D. S. Morrison, 160 Pearl St., New York, N. Y., is architect.

Laboratory—New Haven Hospital, Yale School of Medicine, 330 Cedar St., New Haven, Conn., plans the construction of a hospital including medical and pediatric laboratory on Howard Ave. Estimated cost $1,500,000. H. C. Pelton, 415 Lexington Ave., New York, N. Y., is architect.

Laboratory—Queen City Dental Manufacturers, 112½ Carlton St., Toronto, Ont., awarded general contract for a 2 story laboratory to J. Anderson, 66 Linsmore Crescent, Toronto. Estimated cost $50,000.

Laboratory (Chemical) — Steel & Tubes Inc., H. B. Wick, Chn., 224 East 131st St., Cleveland, O., awarded contract for a 1 story, 80 x 140 ft. chemical laboratory to The Austin Co., 16112 Euclid Ave., Cleveland. Estimated cost $60,000.

Laboratory (Research)—Dept. of Public Works, Parliament Bldg., Ottawa, Ont., will soon receive bids for a 4 story, 150 x 460 ft. research laboratory. Estimated cost $2,000,000. Sproatt & Ralph, 1162 Bay St., Toronto, are architects.

Laboratory Addition — Famous Lasky Corp., 1501 Broadway, Long Island City, N. Y., plans a 2 story, 90 x 120 ft. addition to laboratory at 35th Ave. and 36th St. R. L. Senior, 142 East 43rd St., New York, Archt.

Laboratories (Chemistry and Physics)—School Board, A. N. Hill, Chn., 86 King St., Dundas, Ont., will soon award contract for the construction of a high school including chemistry and physics laboratories on King St. W. Estimated cost $150,000. W. J. Walsh, 403 Terminal Bldg., Hamilton, is architect.

Leather Stamping Plant — Chicago Raw Hide Co., 9000 Alpine Ave., Detroit, Mich., awarded contract for the construction of a 1 story, 85 x 110 ft. leather stamping plant to M. J. Hoffman Construction Co., 8505 West Warren Ave., Detroit. Estimated cost $50,000. Equipment will be installed.

Limestone Mill—Bloomington Limestone Co., Bloomington, Ind., is having plans prepared for the construction of a mill. Estimated cost $300,000. Private plans.

Lye Kettle House—Lever Bros. Co., 164 Broadway, Cambridge, Mass., will soon award contract for a 2 story lye kettle house. C. T. Main Co., 201 Devonshire St., Boston, Mass., is engineer.

Match Factory — Hull Match Co. Ltd., Hull, Que., is having plans prepared for the construction of a match factory on St. Penfleur St. Estimated cost $100,000.

Metal Factory—American Electro Metal Corp., I. P. Schwarzkopf, Lewiston, Me., awarded contract for a 1 story, 110 x 130 ft. plant, to J. A. Greenleaf & Sons Co., 20 Washington St., Auburn, Me. Estimated cost $65,000.

Metallic Ink Factory — Sleight Metallic Ink Co., 712 Federal St., Chicago, Ill., awarded contract for a 2 story, 50 x 113 ft. factory at 717-719 Congress St. W. Estimated cost $24,000.

Oxygen and Nitrogen Plant — American Oxygen Service Co., 225 West 34th St., New York, N. Y., plans the construction of an oxygen and nitrogen plant at 6th and Essex Sts., Harrison, N. J. Estimated cost $40,000. Architect not announced.

Paint and Varnish Factory—Armstrong Paint & Varnish Co., 1318 Kilbourn Ave., Chicago, Ill., awarded contract for a 2 story, 30 x 95 ft. factory at 1358 Kilbourn Ave. Estimated cost $17,000.

Paint and Varnish Factory—W. N. Boysen Co., 2838 Hannah St., Oakland, Calif., awarded contract for the construction of a 1 story factory for the manufacture of paints, varnishes and enamels at 42nd and Linden Sts. to C. D. DeVelbiss, 354 Hobart St., Oakland. Estimated cost $40,000.

Paint and Varnish Factory—Jones-Dabney Co., S. P. Jones, Pres., 11th and Hill Sts., Louisville, Ky., plans the construction of a 3 story, 50 x 80 ft. paint and varnish factory. Estimated cost $75,000. Joseph & Joseph, Breslin Bldg., Louisville, Ky., are architects and engineers.

Paper Mill—Consolidated Paper Co., Elm St., Monroe, Mich., awarded contract for substructure of a 1 story, 120 x 580 ft. warehouse in connection with paper mill to W. V. Knapp Co., Monroe. Estimated cost $200,000.

Paper Mill — Hopper Paper Co., B. H. Hopper, Pres., Taylorville, Ill., is having preliminary plans prepared for the construction of a paper mill for production of paper from cornstalks. Estimated cost $2,000,000.

Paper Mill — International Paper Co., 100 East 42nd St., New York, N. Y., plans the construction of a paper mill at Van Buren, Me., also power plant, 20,000 hp. capacity, on Fish River. Estimated cost $3,000,000.

Paper Mill—New York and Pennsylvania Co., 200 5th Ave., New York, N. Y., awarded contract for a 2 story, 58 x 375 ft. addition to warehouse for paper mill at Lockhaven, Pa. to J. W. Ferguson Co., 152 Market St., Paterson, N. J. Estimated cost $150,000.

Paper Factory Addition—American Lace Paper Co., 908 Junean Ave., Milwaukee, Wis., awarded contract for a 4 story, 82 x 320 ft. addition to paper factory at Point Washington to P. Riesen's Sons, 1018 Humboldt St., Milwaukee.

Paper Mill Additions—Smith Paper Co., South Lee, Mass., awarded contract for additions to Columbia and Niagara mills to Lynch Bros., 225 High St., Holyoke, Mass. Estimated cost $40,000.

Paper Mill Additions — Standard Paper Mfg. Co., Hull and Canal Sts., Richmond, Va., plans additions to paper mill including the installation of a third paper machine for the manufacture of higher grade paper used in color printing. Estimated cost $500,000.

Petroleum Storage and Distribution Plant —Shell Eastern Petroleum Products Co. and Shell Union Oil Co., 65 Broadway, New York, plan the construction of a storage and distribution plant at Sewaren, N. J. Estimated cost $150,000. Architect not selected.

Process Plant and Laboratory — Raybestos Co., A. V. Bodine, Bridgeport, Conn., is receiving bids for a 2 story, 50 x 100 ft. process plant and laboratory at Stratford, Conn. Estimated cost to exceed $40,000. H. C. Elton, 1001 Main St., Bridgeport, is architect.

Pottery — Homer Laughlin China Co., Newell, W. Va., plans the construction of a 1 story pottery. Estimated cost $1,500,000.

Pulp Mill — Greenville Insulating Board Corp., (recently organized), c/o Chicago Mill & Lumber Corp., 111 West Washington St., Chicago, Ill., plans the construction of a new 140 x 540 ft. wood pulp mill at Greenville, Miss.

Rayon Dye House — Watson Mfg. Co., Grand River Ave., Brantford, Ont., awarded contract for a 2 story, 50 x 100 ft. rayon dye house to A. Cromar, Brantford. Estimated cost $50,000. Equipment will be installed.

Rayon Mill—Skenandoa Rayon Co., 15 Broad St., New York, N. Y., plans the construction of a rayon mill at Utica, N. Y. Estimated cost $2,000. B. M. Crouse, Utica, in charge.

Rayon Plant—Industrial Rayon Corp., F. C. Niederhauser, V. Pres., West 98th St. and Walford Ave., Cleveland, O., awarded contract for a 1 story, 42 x 256 ft. addition to rayon factory to George A. Rutherford Co., 2725 Prospect Ave., Cleveland. Estimated cost $110,000.

Refinery (Beet Sugar) — American Beet Sugar Co., c/o F. J. Kasper, Mgr., Rocky Ford, Colo., plans the construction of a refinery at Monte Vista, Colo. Estimated cost $500,000.

Refinery (Beet Sugar) — Holly Sugar Corp., W. J. Reasch, Supt., Tracy, Calif., awarded contract for addition to beet sugar refinery to Dyer Construction Co., Cleveland, O. Estimated cost $200,000. Additional machinery and equipment to cost $60,000 will be required.

Refinery (Copper)—Consolidated Mining & Smelting Co., Canadian Pacific Bldg. and Ventures Ltd., Excelsior Life Bldg., Toronto, Ont., plan the construction of a second copper refinery and zinc production works in Eastern Canada. Estimated cost approximately $25,000,000.

Refinery (Nickel) — International Nickel Co., Port Colbourne, Ont., awarded general contract for the construction of three electrolytic refining units to Fraser Brace Co. Ltd., 83 Craig St., Montreal, Que. Estimated cost $1,500,000.

Refinery (Oil) — Carnegie Refining Co., Heidelburg, Pa., will soon award contract for the construction of an oil refinery and filter house. Estimated cost to exceed $40,000. H. S. Bell, Woolworth Bldg., New York, is engineer.

Refinery (Oil) — Producers Oil Co., Bristow, Okla., is having plans prepared for the construction of a 4 battery high pressure oil refinery. Estimated cost $100,000. Work will be done by owner's forces.

Refinery (Oil)—Transcontinental Oil Co., Ritz Bldg., Tulsa, Okla., has acquired a 400 acre site at Texas City, Tex. and plans the construction of an oil refinery 30,000 bbl. capacity in connection with proposed pipe line from Pecos to Texas City. Estimated cost of plant $6,000,000. Private plans.

Refinery (Oil) **Addition** — McCall Bros. Ltd., 114 Don Esplanade St., Toronto, will build an addition to oil refinery. Estimated cost $250,000. Equipment will be required.

Refinery (Sugar)—American Beet Sugar Co., Steel Bldg., Denver, Colo., will soon receive bids for the construction of a 69 x 212 ft. sugar refinery at Belmond, Ia. Estimated cost $1,000,000. F. H. Ballou, c/o owner, is engineer.

Rubber Factory Addition — Canadian Goodrich Co., J. W. Jordan, Mgr., Kitchener, Ont., plans addition to rubber factory on King St. W. Estimated cost $100,000.

Rubber Factory Addition — Seiberling Rubber Co. of Canada Ltd., 99 Paton Rd., Toronto, Ont., plans the construction of a 1 story addition to rubber factory on Paton Rd. Estimated cost $40,000. Private plans.

Rubber Reclaiming Plant—Goodyear Tire & Rubber Co., 1144 East Market St., Akron, O., c/o H. Zieske, Gadsden, Ala., Engr., will soon award contract for the construction of a 100 x 380 ft. rubber reclaiming plant at Gadsden. Estimated cost $1,000,000.

Silica Plant—Columbia Silica Co., Copley Rd., Akron, O., plans to rebuild plant destroyed by fire on Copley Rd. Estimated cost $50,000.

Smelting Plant — American Smelting & Refining Co., Equitable Bldg., New York, N. Y., plans extensions and improvements to smelting plant, also constructing large Cottrell plant for eliminating smoke at El Paso, Tex. Estimated cost $200,000. Work will be done by day labor.

Soap Factory — Procter & Gamble Co., Port Ivory, N. Y., awarded contract for 1, 2 and 4 story additions to factory to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $50,000.

Radio Tubes Factory — Sylvania Products Co., Emporium, Pa., will soon award contract for a 1 story, 80 x 240 and 40 x 80 ft. addition to factory. Estimated cost $150,000. Private plans.

Tile Plant—Tylac Co. Inc., Monticello, Ill., plans the construction of an 80 x 100 ft. plant for the manufacture of lacquered wood fiber tile for interior building use. Estimated cost $40,000.

Wrapping Paper Factory—DuPont Cellophane Co., subsidiary of E. I. DuPont de Nemours Co., Abbott Rd. and Orchard Park, Buffalo, N. Y., plans the construction of a factory for the manufacture of cellophane transparent wrapping paper at Old Hickory, Tenn. Estimated cost $2,000,000 to $3,000,000. Private plans.